BERICHTE
aus dem Fachbereich Geowissenschaften
der Universität Bremen

No. 236

Meinecke, G., M. Bergenthal, C. Begler,
A. Ciancar, S. Klar, E. Kopiske, L. Marotto,
A. Pink, G. Ruhland, R. Tattermusch
M. Villagarcia

REPORT AND PRELIMINARY RESULTS OF POSEIDON CRUISE 305 LAS PALMAS (SPAIN) - LISBON (PORTUGAL) October 28th -November 06th, 2003

Berichte, Fachbereich Geowissenschaften, Universität Bremen, No.236 ,
43 pages, Bremen 2005

ISSN 0931-0800

The „Berichte aus dem Fachbereich Geowissenschaften“ are produced at irregular intervals by the Department of Geosciences, Bremen University.
They serve for the publication of experimental works, Ph.D.-theses and scientific contributions made by members of the department.

Reports can be ordered from:

Monika Bachur
Forschungszentrum Ozeanränder, RCOM
Universität Bremen
Postfach 330 440
D 28334 Bremen
Phone: (49) 421 218-8960
Fax: (49) 421 218-3116
e-mail: mbachur@uni-bremen.de

Citation:
Meinecke, G. Dr. and participants
Report and preliminary results of Poseidon Cruise 305, Las Palmas – Lisbon, 28.10. – 06.11.2003.
Berichte, Fachbereich Geowissenschaften, Universität Bremen, No. 236, 43 pages, Bremen, 2005

ISSN 0931-0800

CONTENTS

1. Participants

Participants R/V POSEIDON cruise 305

Name	Domain	Institution
Meinecke, Gerrit Dr.	Marine Geology (Chief scientist)	GeoB
Bergenthal, Markus	Marine Technology	GeoB
Begler, Christian	Student	IFM
Ciancar, Andres	Marine Chemistry	ICCM
Klar, Steffen	Marine Technology	GeoB
Kopiske, Eberhard	Marine Geology	GeoB
Marotto, Leire	Marine Chemistry	ICCM
Pink, Andreas	Marine Technology	IFM
Ruhland, Götz	Marine Geology	GeoB
Tattermusch, Ralf	Technician	GeoB
Villagarcia, Marimar	Marine Chemistry	ICCM

Institutions

GeoB Dept. of Geosciences FB5, University of Bremen, Klagenfurter Straße, 28359 Bremen, Germany

ICCM Instituto Canario de Ciencias Marinas, Apto. Correos 55, 35200 Telde de Gran Canaria, Spain

IFM Institut für Meereskunde, Universität Kiel, Düsternbrooker Weg 20, 24105 Kiel, Germany

ULPGC Universidad de Las Palmas de G. Canaria, Edificio de Ciencias Básicas, Campus Universitario Tafira, E-35017 Las Palmas de Gran Canaria, Canary Islands, Spain

2. Research Objectives

The upwelling area off NW-Africa is one of the most important upwelling systems of the global ocean, influenced by high amounts of Sahara dust which is transporting nutrients into the ocean. Both factors are of fundamental importance for the particle production in the ocean, influencing the processes of the biological carbon pump system. Hence, they are controlling factors of the global atmospheric CO_2-budget. Despite the main driving-force for climatic variability is located in the North-Atlantic, the upwelling area off NW-Africa is suitable to reconstruct the past climatic variability, via observation of present in-situ environmental datasets. During R/V POSEIDON cruise 305 it was planned to work in the main research area Canary Islands.

DOLAN (Operational Data Transmission in the Ocean and Lateral Acoustic Network in the Deep-Sea)

The second main topic of R/V POSEIDON cruise 305 will be the work at DOLAN site. The station is located 25 nm west of ESTOC site and comprises technological devices for transmission of scientific data sets by means of acoustic communication in the water column via satellite into the internet and research institutes.

DOBS (Deep Ocean Bottom Station)

This mooring array is linked to the DOLAN surface buoy mooring (SBU) as an additional acoustic client and will be maintained during this cruise.

ANIMATE (Atlantic Network of Interdisciplinary Moorings and Time series for Europe)

Finally, the third task in this research area will concentrate on the ANIMATE EU project, which is closely linked to the ESTOC and DOLAN project. In the ANIMATE project, moorings were deployed on key sites in the northern Atlantic (ESTOC, Canary Islands; PAP, Porcupine Abyssal Plain; CIS, Central Irminger Sea) in order to gain data of CO_2, nutrients and fluorescence, which will be transmitted directly via satellites to the participating scientific institutes. A significant element in ANIMATE is the technology for the transmission of datasets from deep-sea, still in use in the DOLAN project. Till year 2003, ESTOC was used as reference site for the subtropical NE-Atlantic within the ANIMATE project. Since spring 2003, a mooring array (ANIMATE Canary Island, ACI), consisting of several scientific sensors (MicroCats, currentmeter, ADCP) was moored 25 nm northwest of ESTOC.

3. Narrative of the Cruise

R/V POSEIDON left the port of Las Palmas on October 28th with heading to ANIMATE position. During the transit 6 XBT´s were launched. In the afternoon at the same day station work at ANIMATE site started with two CTD/Rosette casts down to 3610 m water depth. In the morning of October 29th the ANIMATE ACI-2 mooring was successful recovered and R/V POSEIDON steamed on to DOLAN position. After arriving at the DOLAN position the SBU surface buoy was recovered until afternoon. Subsequently several acoustic tests were done. In the beginning of October 30th the first scientific task was the lowering of two CTD/Rosette cast down to 3609 m water depth. As preparation work for the new ANIMATE mooring work was continued with a CTD/MicroCats calibration cast down to 500 m water depth using the rosette frame. In addition, one NOAA drifter was deployed. In the afternoon some transducer tests were done.

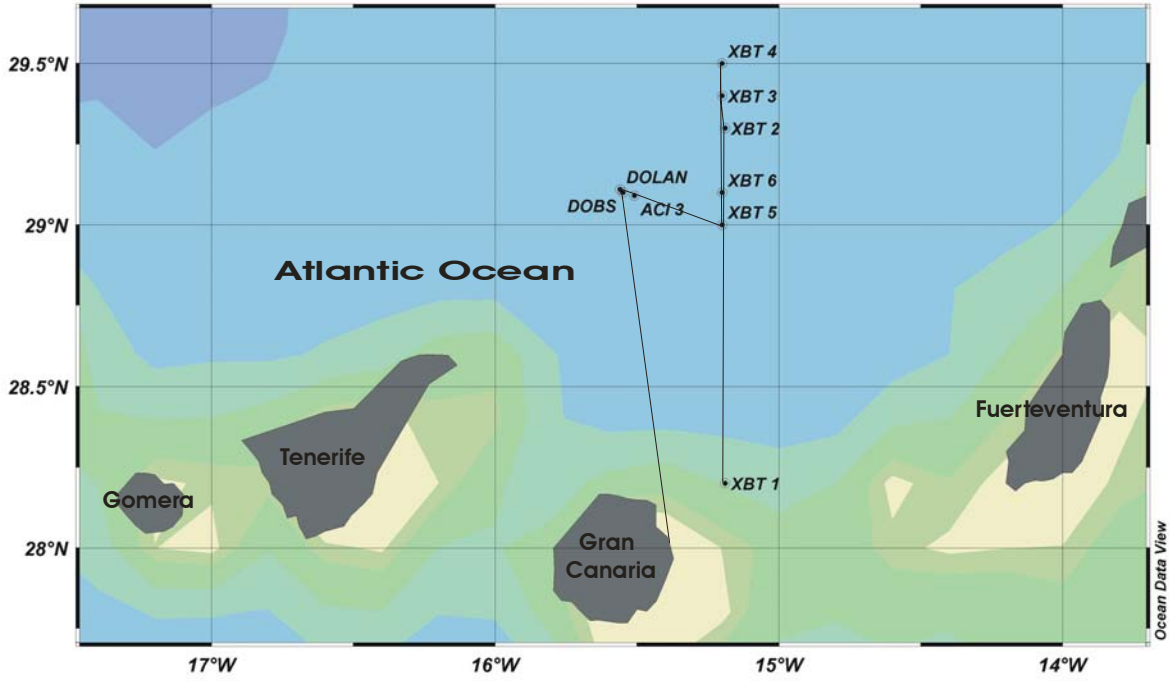


Figure 1: Cruise track and main stations during R/V POSEIDON cruise 305.

October 31st started with several acoustic tests. After that, the DOLAN-SBU was redeployed. The noon was used for communication tests. The scientific work at this day finished with acoustic tests and R/V POSEIDON left DOLAN site with heading to ANIMATE position. The next day the ANIMATE ACI-3 and the new DOBS mooring array were successfully deployed. During the forenoon of November 2nd two CTD/Rosette cast down to 3613 m were lowered. In the afternoon station work was continued with operation of another two CTD/Rosette casts down to 3610 m water depth. The scientific work ended with several modem tests and was finished in the early evening. The R/V POSEIDON steamed back to the Canaries and arrived at Las Palmas harbour late in the evening. All station work could be completed as planned.

4. Scientific Report

4.1 Particle Sampling with Sediment Traps

The particulate material collected will be analysed to determine total flux, particulate flux, particulate organic carbon, particulate nitrogen, biogenic opal, carbonate and stable isotopes of organic matter, and lithogenic material. The trapped material also will be investigated for species composition of the planktonic organisms (pteropods, foraminifera, coccolithophorides and diatoms). The objective of these studies is to identify signals of seasonal variations in those components, which play an important role in the sediment formation process. The results of these investigations will form a basis for the reconstruction of paleo-current and paleoproduction systems of the Canary Island region.

All data of recovery and deployment of the mooring arrays are listed in Tab. 1, together with sampling data of sediment traps.

4.1.1 ANIMATE Canary Island Mooring (ACI-2/ACI-3)

On October 29th the ACI-2 mooring, located at 29°08,00`N and 15°50,00`W in 3628 m water depth, was recovered. This study site was at least deployed in spring 2003 during the R/V POSEIDON cruise 296. Attached to the ACI-2 array were one sediment trap and one currentmeter (other devices described in chapter 4.2). The sediment trap provided the whole sample set of 14 cups. The array was redeployed as ACI-3 with the same configuration on October 31st. It is planned to recover this mooring array in spring 2004 with R/V POSEIDON.

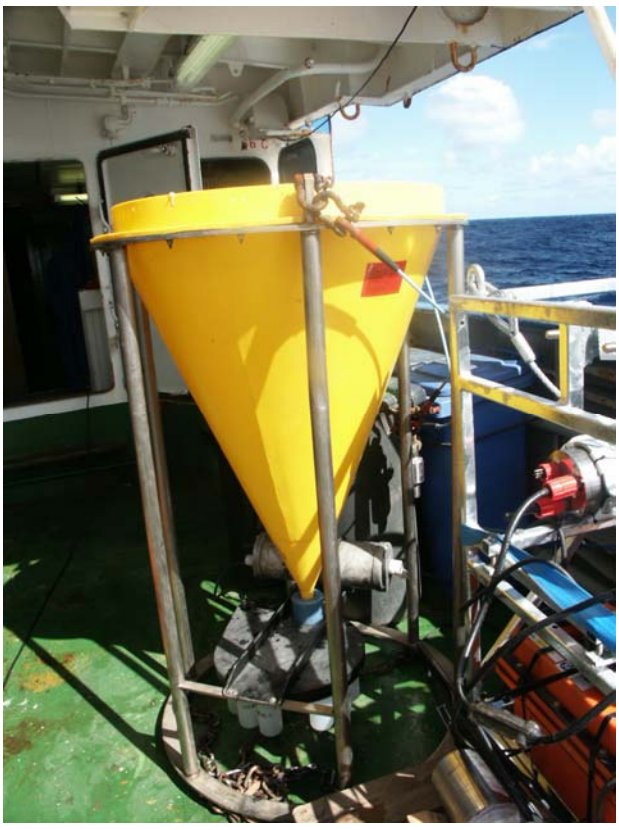


Figure 2: Recovered SN 532 McLane sediment trap.

Table 1: Mooring data for recoveries and redeployments during R/V POSEIDON cruise 305.

Mooring	Position	Water depth (m)	Interval	Instr.	Device (m)	Intervals depth (no x days)
Mooring recoveries						
ANIMATE ACI-2	29°09,60`N 15°50,05`W	3628	20.04.03 - 04.04.04	SN 532 (SOC)	2996	2 x 21, 11 x 28
				RCM 8	3019	
Mooring deployments						
ANIMATE ACI-3	29°09,60`N 15°50,05`W	3628	16.11.03 - 20.06.04	SN 532 (SOC)	2996	5 x 21, 8 x 14
				RCM 8	3019	

Instruments used:
SN 532 = SOC McLane
RCM 8 = Aanderaa current meter, RCM 8

4.2 Equipment Development and Tests

4.2.1 DOLAN-SBU and DOBS-N

During R/V POSEIDON cruise 305 the DOLAN mooring was recovered for maintenance reasons and for integration of additional components into the Surface Buoy Unit (SBU). The SBU operates since 1997 and was formerly part of the DOMEST project. The unit serves for the development of satellite based telemetry technologies including data transmission into and from the deep ocean via acoustic modems. The data link is based on a sensor network moored in the Canary Island area.

Figure 3: Recovery of the DOLAN SBU.

On October 29th the DOLAN mooring array was recovered, which is located at 29°11,03`N and 15°55,36`W at a water depth of 3630 m. The last routine maintenance has been carried out during cruise M 58/3 in spring 2003. Fig. 4 shows the slide bio fouling of the SAMI sensor.

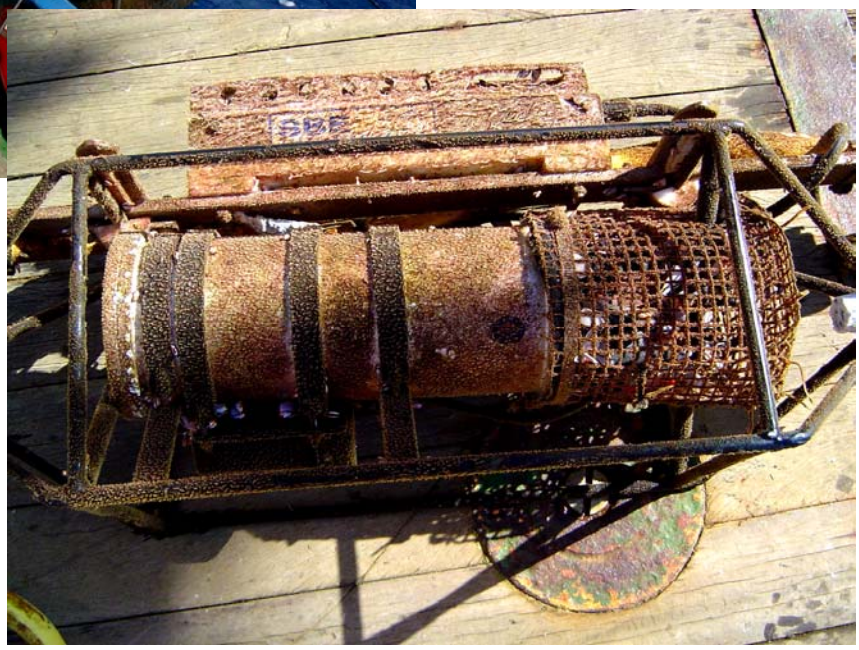


Figure 4: Bio fouling of the SAMI sensor and the MicroCat.

Configuration of the SBU

The configuration of the surface unit has not changed compared to the earlier deployment. All sensors have been maintained, the wind vane and the anemometer have been repaired.

The Inmarsat Mini-C tracking unit has been checked in order to determine the high power consumption during the last deployment phase. The measurement shows a low consumption, but the batteries were empty again after two weeks deployment, due to a cable problem.

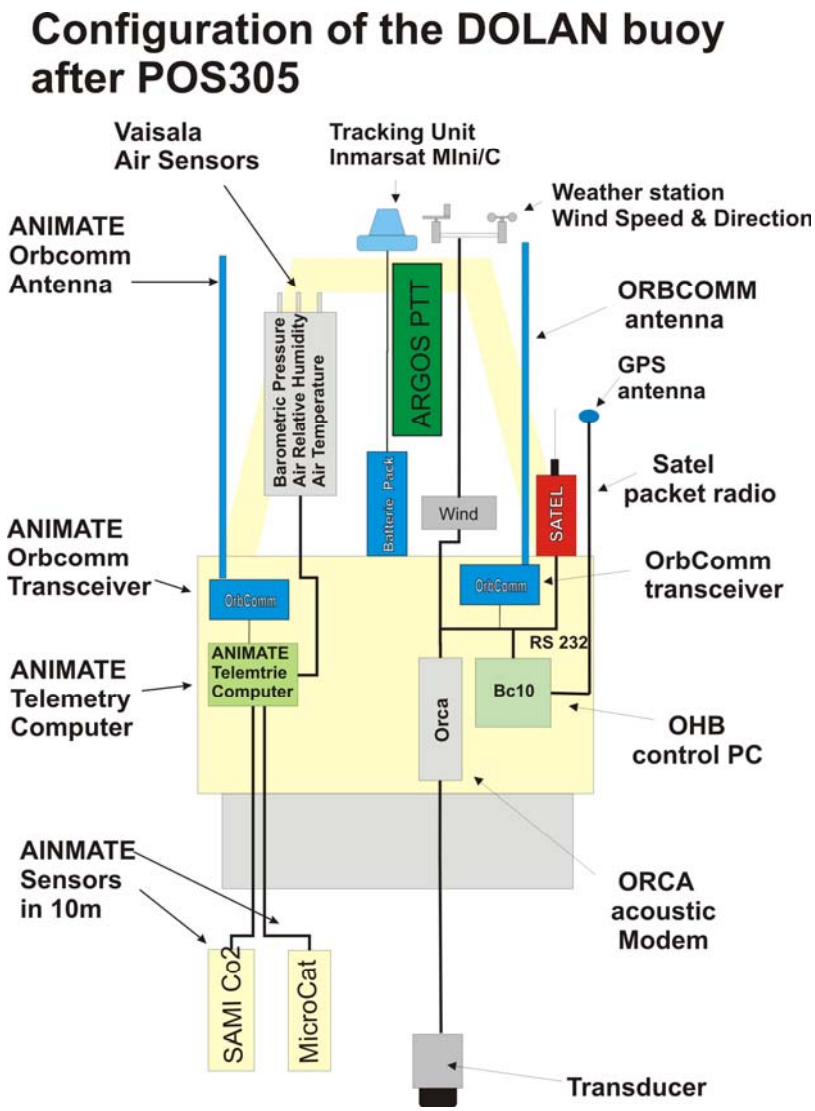


Figure 5: Configuration of the DOLAN buoy after R/V POSEIDON cruise 305.

The ANIMATE telemetry for the SAMI CO_2 sensor and the MicroCat at 10 m water depth has been working well, also the set of Vaisala air sensors with air temperature, humidity and barometric pressure. The telemetry has been maintained and redeployed.

The main work was on the underwater acoustic link. A number of tests have been performed with the SBU and the DOBS-N unit. A new microcontroller board has been

developed in order to implement new sensors and an automatic scheduled reporting of sensor data. An echo-functionality has been implemented for test purposes. These features have been tested with the underwater unit and surface unit. It turned out that the BC10 computer was not able to conduct the messages generated on the DOBS-N sensor frame. The functionality was in the software documentation, but did not work.

The DOLAN-SBU mooring array was redeployed on October 31st. The next routine maintenance is planned for the POSEIDON cruise 310 in spring 2004.

Figure 6: Redeployment of the DOLAN-SBU.

Figure 7: Deployment of the SAMI sensor, MicroCat and the transducer.

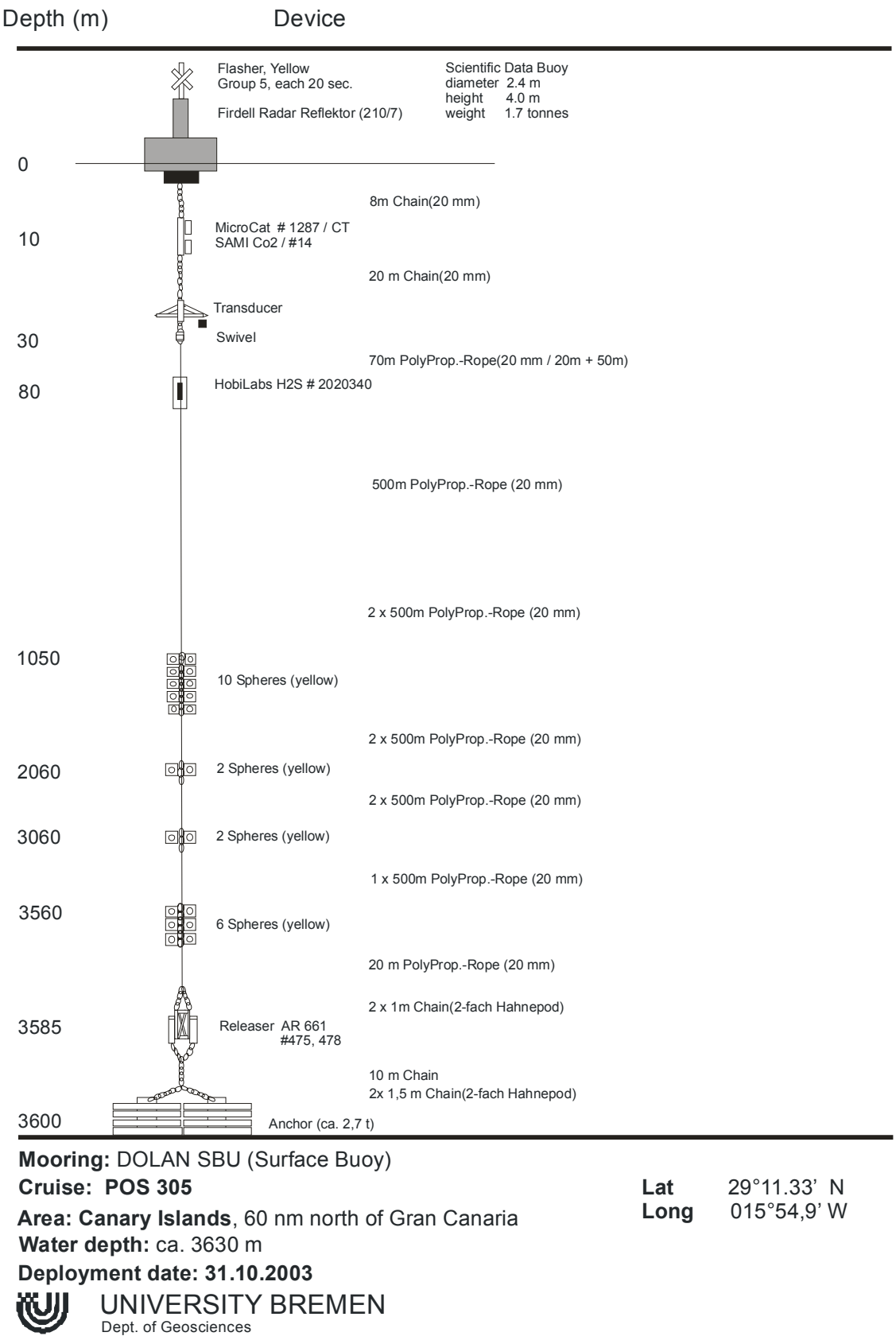


Figure 8: Drawing of the DOLAN SBU mooring.

During POSEIDON cruise 305 a new mooring was setted. The DOBS-N array is closely linked to the DOLAN site, and was deployed on November 1st. It contains additional sensors, like a scattering sensor, and acoustic client units.

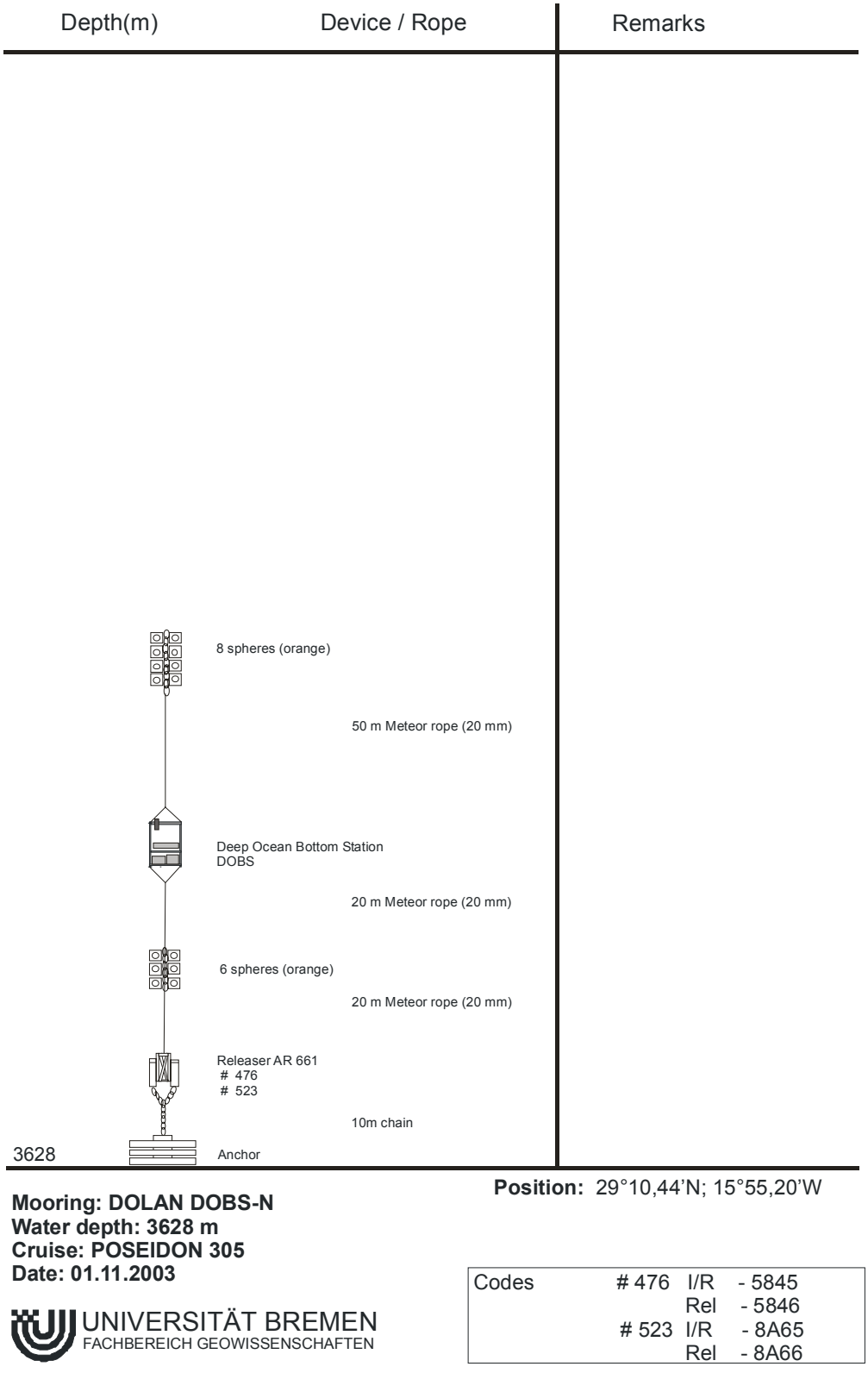


Figure 9: Drawing of the DOBS-N mooring.

4.2.2 SAMI (CO_2 sensor)

The SAMI-CO_2 is a renewable reagent fibre optic sensor for measuring the partial pressure of carbon dioxide in water. It is capable of measuring the partial pressure of carbon dioxide over a range of approximately 200-600 µatm with a precision of ~ 1 µatm, unattended for up to one year. Its PVC housing is rated to withstand pressures up to 100 m. The sensor had been deployed for the second time within the DOLAN array at a depth of 10 m, recording data in two hour intervals. The recorded data of the SAMI-CO_2 sensor were not read out after recovery and the sensor was sent back to the manufacturer, via IfM, for maintenance. On October 31st a new SAMI-CO_2 was deployed at a depth of 10 m within the DOLAN array, after an onboard testing phase.

4.2.3 Fluorometer

The HydroScat-2 is a fully autonomous in-situ optical backscattering sensor that measures the backscattering coefficient at two wavelengths and fluorescence at one wavelength. Measurements are made once per hour providing an accurate description of the particles in the water column and the chlorophyll concentration. The sensor had been deployed for the second time within the DOLAN array at a depth of 80 m recording data in 60 min intervals. The recorded data of the Fluorometer were read out after recovery. The Fluorometer was calibrated on October 31st and redeployed on the same day.

4.2.4 Nutrient Analyser

The NAS-2E is an in-situ nutrient analyzer for high-frequency time-series determination of nutrient concentrations in marine and fresh waters. Four versions are available for the measurement of nitrate (and/or nitrite), phosphate, silicate and now ammonia. The NAS-2E is typically deployed unattended for periods up to 60 days, although much longer deployments have been achieved. The device may be used near surface, in buoy and riverine applications, or be deployed at depths to 250 m in taut-line mooring scenarios. On the ANIMATE moorings only Nitrate was measured in the first instance. The data were read out, but due to several problems, which could not solve onboard, the Nutrient Analyzer was not redeployed.

4.2.5 MicroCats

The MicroCats are high accuracy temperature and conductivity sensors which record and internally store these two variables at high data rate (e.g. every 10 min) for up to one year. Within the ACI array the MicroCats are deployed in sets of single sensors, moored at specific depths to follow mixed-layered evolution and processes. The data are recorded in the internal memory of the MicroCats and transmitted to the ARGOS telemetry via an inductive link. The ARGOS telemetry sends the data online via satellite link.

During the cruise the MicroCats have not been read out, only calibrated prior to redeployment. The MicroCats of the ACI array have been rearranged according their mooring depths.

4.2.6 ANIMATE

The ANIMATE array was at least deployed during POSEIDON cruise 296 on April 12th. The ACI-2 was recovered on October 29th. It includes the ARGOS telemetry buoy, 8 MicroCats, a floatation sphere with an ADCP, one sediment trap and one currentmeter. The array was redeployed as ACI-3 on November 1st with the same configuration as ACI-2.

Figure 10: Deployment of the floatation sphere telemetry.

Figure 11: Deployment of the ARGOS telemetry.

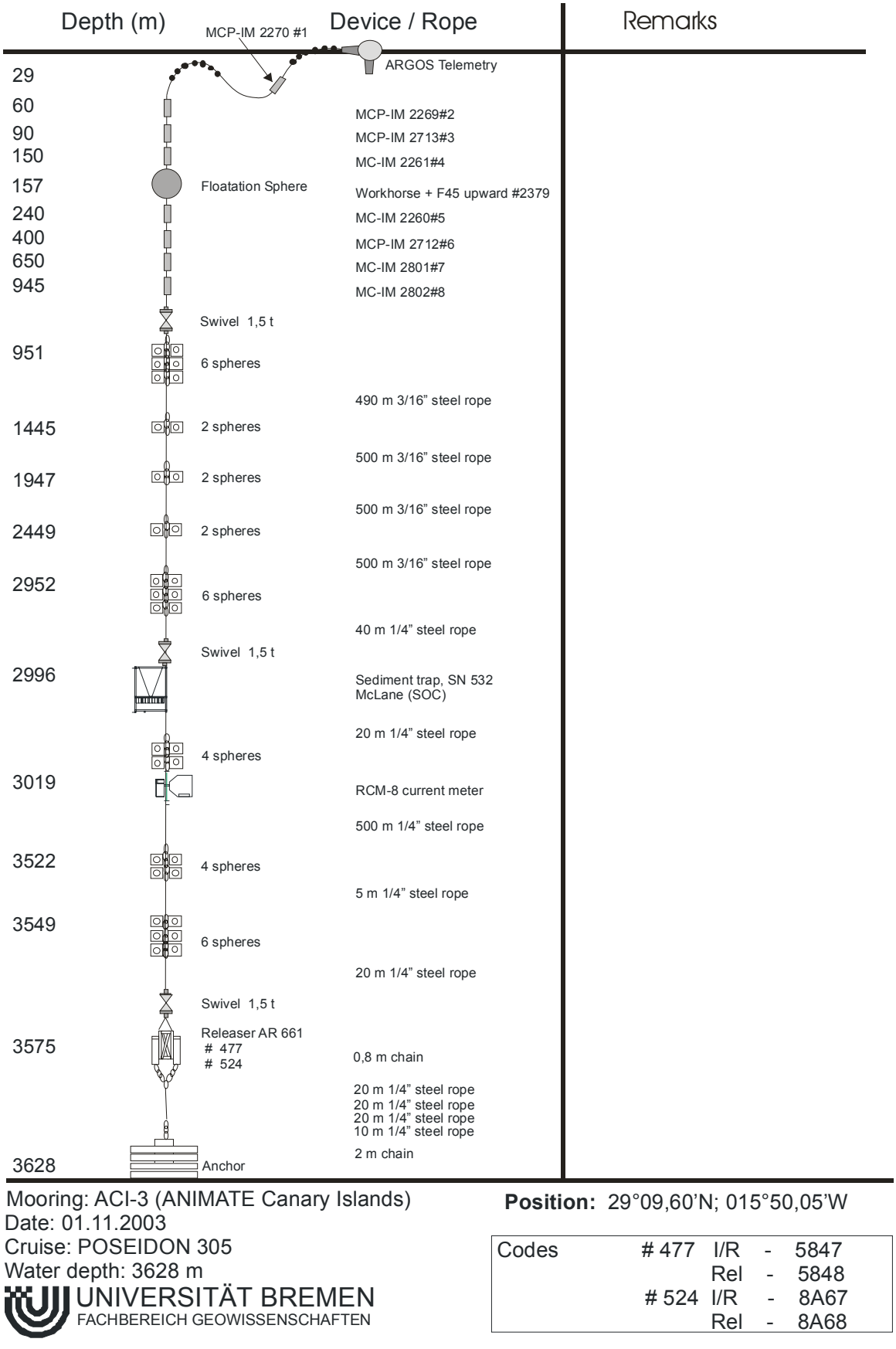


Figure 12: Drawing of the ANIMATE mooring array ACI-3.

4.2.7 Acoustic Modem

Another scientific task of the POSEIDON cruise 305 was the test of a new underwater acoustic modem. The test has been carried out on November 2nd at the DOLAN position (29°11,04´N, 15°55,44´W). It included the installation off the components, a test on deck, one test profile down to 2500 m water depth and the deinstallation off the components. The underwater unit was attached in a frame, which was placed at a disposal by the University Bremen. The deck unit could smooth connected to the onboard LAN net. Although the sender was working, the onboard test phase failed. We decided to run the test profile without a successful air test. During the profile it was tried to establish an acoustic communication in several water depths (Tab. 2).

downwards	communication	upwards	communication
100 m	√	2500 m	-
500 m	√	2300 m	-
1000 m	√	2200 m	-
1500 m	√	2100 m	-
2000 m	√	2000 m	-
2500 m	-	1800 m	-
		1000 m	-
		200 m	-

Table 2: Water depth of the communication profile.

Indeed often more than one attempt was necessary to build up a communication, but at least in all depths of the downwards profile the communication could hold on. At a depth of 2500 m it was impossible to establish a contact, despite of several attempts. During the upwards profile it was not possible to get any connection. After the test run the different components were controlled and the batteries were reloaded. The rechargeable battery of the underwater unit was viewable discharged, while the batteries of the deck unit were nearly full.

4.2.6.1 Evaluation

The test shows, that the modem is principally able to send data up from 2000 m water depth. In most of the water depth several attempts were necessary to get a stabile communication. This problem could be caused by the ships background noise, and it is well known from other acoustic modems. To eliminate this noise, it seems to be useful to test the modem on a buoy. What although should be tested is the effective data transmission rate and the failure rate. Both could not be tested during this cruise, due to missing parameters.

Condensed, the device has the status of an advanced prototype. Several points have to be worked on, before going in series production:

- integration of an user interface
- extend the working depth
- energy consumption (sleep / wake up mechanism)

4.3 Marine chemistry

During R/V POSEIDON cruise 296 the biogeochemical monthly samplings at the ESTOC station (**E**uropean **S**tation for **T**ime series in the **O**cean **C**anary Islands), which were continuously done since 1994, were made.

Calibration casts with CTD/Rosette were also made to accomplish the requirements of the sensors being recovered and deployed.

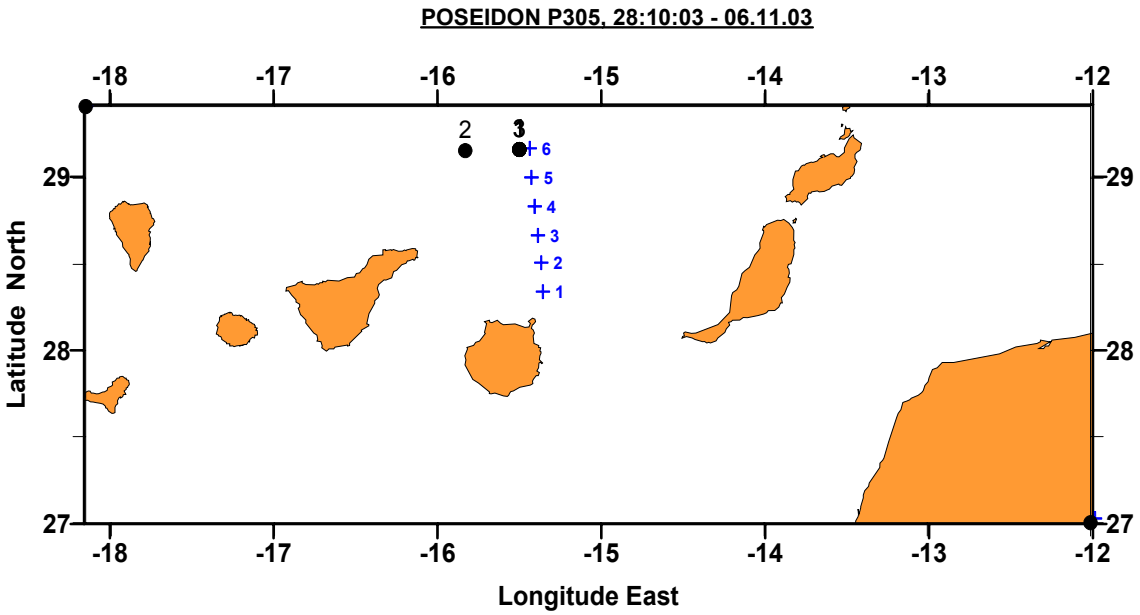


Figure 13: Position of the CTD stations (dots) and XBT launches (crosses) made by ICCM along R/V POSEIDON cruise 305.

Three stations with several casts were sampled at the ESTOC and the DOLAN positions (see map in Fig. 13). The two samplings at ESTOC were run to the bottom and the calibration cast for the fluorometer was only made to 500 m of nominal depth due to restrictions of the device. A CTD/Rosette unit with 12 bottles was used. Physical (CTD, salinity) and biochemical (oxygen, alkalinity, pH, nutrients, chlorophyll) parameters were measured in order to characterize the water masses present in the study area (Tab. 3). Some of the parameters (oxygen, alkalinity, pH, chlorophyll filtration) were analysed onboard after sampling and others were taken frozen to the ICCM (nutrients and filters from chlorophyll). Additionally, and as part of the ESTOC customary sampling scheme, 6 XBT's (eXpendable BatiThermograph) were launched to 1800 m on the transit from Las Palmas to the ESTOC station (Tab. 4).

Table 3: List stations sampled along the cruise between Las Palmas and ESTOC-ANIMATE (0=oxygen, A= alkalinity, P=pH, N=nutrients, S=salinity, C=chlorophyll "a", INCID.= incidences).

Date	St. #, Cast #	water depth	Lat. (N)	Long. (W)	sample depth	PARAMETERS O	A	P	N	S	C	INCID.
28.10	1, 001	3602	29°10.00'	15°30.00'		Test cast at ESTOC station						
28.10	1, 002	3602	29°10.00'	15°30.00'	2000	√	√	√	√	√		
	ESTOC 10/03				1800	√	√	√	√	√		
					1499	√	√	√	√	√		
					1300	√	√	√	√	√		
					1200	√	√	√	√	√		
					1100	√	√	√	√	√		
					1000	√	√	√	√	√		
					800	√	√	√	√	√		
					600	√	√	√	√	√		
					400	√	√	√	√	√		
					299	√	√	√	√	√		
					200	√	√	√	√	√		
30.10	1, 003	3602	29°10.00'	15°30.00	203	√	√	√	√	√	√	
	ESTOC 10/03				152	√	√	√	√	√	√	
					128	√	√	√	√	√	√	
					101	√	√	√	√	√	√	
					76	√	√	√	√	√	√	
					51	√	√	√	√	√	√	Water
					25	√	√	√	√	√	√	losses
					12							
30.10	1, 004	3602	29°10.00'	15°30.00	3562	√	√	√	√	√	√	
	ESTOC 10/03				3000	√	√	√	√	√	√	
					2800	√	√	√	√	√	√	
					2500	√	√	√	√	√	√	
					2000	√	√	√	√	√	√	
30.10	2, 001	3602	29°09.61	15°49.90	501				√			√ N
					149				√		√	√ U
	Calibration fluorometer				123				√		√	√ T
	ANIMATE/ESTOC				100				√		√	√ R
					90				√		√	√ I
					80				√		√	√ E
					70				√		√	√ N
					54				√		√	√ T
					39				√		√	√ S
					25				√		√	√ O
					10				√		√	√ C
02.11	3, 001	3602	29°10.00'	15°30.00	3562	√	√	√	√	√		
	ESTOC 11/03				3000	√	√	√	√	√		
					2800	√	√	√	√	√		
					2500	√	√	√	√	√		
					2000	√	√	√	√	√		
					1800	√	√	√	√	√		
					1500	√	√	√	√	√		
					1300	√	√	√	√	√		
					1200	√	√	√	√	√		
					1100	√	√	√	√	√		
					1000	√	√	√	√	√		
					800	√	√	√	√	√		
					800	√	√	√	√	√		
					600	√	√	√	√	√		Water
												losses
					400	√	√	√	√	√		
					300	√	√	√	√	√		
					200	√	√	√	√	√	√	
					150	√	√	√	√	√	√	
					125	√	√	√	√	√	√	
					100	√	√	√	√	√	√	
					50	√	√	√	√	√	√	
					10	√	√	√	√	√	√	

Table 4: List of XBT that were launched between Las Palmas and ESTOC during R/V POSEIDON cruise 305.

XBT sta #	Date	Latitude	Longitude
ESTOC-D6	04.04.2003	28°20,00'N	15°30.00'W
ESTOC-D5	04.04.2003	28°30,00'N	15°30,00'W
ESTOC-D4	04.04.2003	28°40.00'N	15°30,00'W
ESTOC-D3	04.04.2003	28°50.00'N	15°30,00'W
ESTOC-D2	04.04.2003	29°00.00'N	15°30,00'W
ESTOC-D1	04.04.2003	29°10,00'N	15°30,00'W

4.3.1 Water Sampling and Analysis

Samples were collected immediately after the Niskin bottles were on board from each depth. The sampling sequence was as follows:

Oxygen

Oxygen was taken in glass bottles of about 125 ml of volume which were previously cleaned and washed with HCl acid and fixed at once; then it was kept for at least six hours according to WOCE regulations and finally it was analysed at the laboratory onboard the ship. The samples were analysed using the method described in the WOCE Operations Manual, WHP Office Report No. 68/91; the final titration point was detected using a Metrohm 665 Dosimat Oxygen Auto-Titrator Analyser.

Nutrients

Nutrients were taken in polypropylene bottles which were previously cleaned and washed with HCl acid and completely dry. Samples were immediately frozen at -20°C, analysing them as soon as possible after arrival at the laboratory. Freezing the samples is a common practice; it does not or only in a non-significant way affects the nitrate+nitrite and the phosphate values (by a slight decrease) and is not noticeable in the silicate values (Kremling and Wenck, 1986; McDonald and McLunghlin, 1982).

Salinity samples were taken in dark glass bottles which were previously cleaned and washed with HCl acid. Then, they were kept in boxes to protect them from light till analysis on land.

The nutrients determination was performed with a segmented continuous-flow autoanalyser, a Skalar® San Plus System (ICCM).

Nitrate and Nitrite

The automated procedure for the determination of nitrate and nitrite is based on the cadmium reduction method; the sample is passed through a column containing granulated copper-cadmium to reduce the nitrate to nitrite (Wood et al., 1967), using ammonium chloride as pH controller and complexer of the cadmium cations formed (Strickland and Parsons, 1972). The optimal column preparation conditions are described by several authors (Nydahl, 1976; Garside**,** 1993).

Phosphate

Orthophosphate concentration is understood as the concentration of reactive phosphate (Riley and Skirpow, 1975) and according to Koroleff (1983a) is a synonym of "dissolved inorganic phosphate". The automated procedure for the determination of phosphate is based on the following reaction: ammonium molybdate and potassium antimony tartrate react in an acidic medium with diluted solution of phosphate to form an antimony-phospho-molybdate complex. This complex is reduced to an intensely blue-coloured complex, ascorbic acid. The complex is measured at 880 nm. The basic methodology for this anion determination is given by Murphy and Riley (1962); the used methodology is the one adapted by Strickland and Parsons (1972).

Silicate

The determination of the soluble silicon compounds in natural waters is based on the formation of the yellow coloured silicomolybdic acid; the sample is acidified and mixed with an ammonium molybdate solution forming molybdosilicic acid. This acid is reduced with ascorbic acid to a blue dye, which is measured at 810 nm. Oxalic acid is added to avoid phosphate interference. The used method is described in Koroleff (1983b).

Phytoplankton pigments

Pigments were measured using fluorimetric analysis, following the methodology described by Welschmeyer (1994). The determination was achieved using a fluorometer TURNER 10-AU-000.

Salinity

Samples were measured with a salinometer, model Autosal 8400a, whose measurement range was between 0.005-42 (psu), with an accuracy of ±0.003, according to the manufacturer. It was calibrated following the manufacturer´s information and standarizing it with IAPSO Standard Seawater. Salinity values were calculated as practical salinity according to Unesco (1978, 1984).

Chlorophyll

Chlorophyll samples of one litre of water were taken. The chlorophyll samples were filtered immediately and the filters were frozen subsequently at -20°C. Their analyses take place at the ICCM laboratory in land.

Carbonate system measurements, in this case pH (at ESTOC only) and alkalinity: samples were taken in glass bottles and were fixed immediately on board. Finally, they were also analysed on board along the cruise. Additionally, fugacity of carbon dioxide in the air and in the seawater was determined using a flow system continuously along the ship track.

Carbonate system measurements

The pH_t in total scale (mol (kg-SW)$^{-1}$) was measured following the spectrophotometric technique of Clayton and Byrne (1993) using the m-cresol purple indicator (DOE, 1994). 0.0047 pH units were added to the pH experimental values in order to take into consideration the recommendations by Lee et al. (2000). A system similar to that described by Bellerby et al. (1995) was developed in our lab. The pH_t measurements were carried out using a Hewlett Packard Diode Array spectrophotometer in a 25°C-thermostated 1-cm flow-cell using a Peltier system. A stopped-flow protocol was used to analyse seawater previously thermostated to 25°C for a blank determination at 730, 578 and 434 nm. The flow was restarted, and the indicator injection valve switched on to inject 10 µl dye through a mixing coil (2 m). Three photometric measurements were carried out for each injection in order to remove all dye effect on the seawater pH_t measurement. Repeatedly, seawater measurements of the different Certified Reference Materials (CRM provided by Dr. Dickson, Scripps Institution of Oceanography) samples gave a standard deviation of ± 0.0015 (n = 54).

The total alkalinity of seawater (A_T) was determined by titration with HCl to the carbonic acid end point using two similar potentiometric systems, as described in more detail by Mintrop et al. (2000). In order to yield an ionic strength similar to open ocean seawater, the HCl solution (25 l, 0.25 M) was made from concentrated analytical grade HCl (Merck®, Darmstadt, Germany) in 0.45 M NaCl. The acid was standardised by titrating weighed amounts of Na_2CO_3 dissolved in 0.7 M NaCl solutions. The total alkalinity of seawater was evaluated from the proton balance at the alkalinity equivalence point, pH_{equiv} = 4.5, according to the exact definition of total alkalinity (Dickson, 1981). The performance of the titration systems was monitored by titrating different samples of certified reference material (CRM, batch 42) with known inorganic carbon and A_T values. The agreement between our data and CRM values was within ±1.5 µmol kg^{-1}. Total inorganic carbon (C_T) is computed from experimental values of pH_t and total alkalinity, using the carbonic acid dissociation constants of Mehrbach after Dickson and Millero (1987). This set of constants presented the best agreement between C_T(pH, A_T) calculations and certified C_T values for CRM, batch 42, with a C_T residual of ± 3 µmol kg^{-1}, n=54 (Millero, 1995, Lee et al., 1997).

Fugacity of carbon dioxide (fCO_2) in the air and in surface seawater was determined using a flow system similar to the unit designed by Wanninkhof and Thoning (1993) and developed by Frank J. Millero´s group at the University of Miami. The equilibrator used is based on the design by R.F. Weiss and described by Butler et al (1988). The concentration of CO_2 in the air and in the equilibrated air sample was measured with a differential, non-dispersive, infrared gas analyser supplied by LI-COR (LI-6262 CO_2/H_2O Analyser). The sample was measured wet and the signal corrected for water vapour using the water channel of the LI-COR detector. The instrument was operated in the absolute mode and gathered CO_2 concentrations directly from the instrument. The LI-COR instrument analyses the concentration of CO_2 every six seconds, then averaged these values over a 5-min interval, and recorded them. Atmospheric air was pumped at the bow of the ship and measured every hour. The system was calibrated by measuring two different standard gases with mixing ratios of 348.55 and 520.83 ppm CO_2 in the air. These calibrated standards were provided by the National Oceanographic and Atmospheric Administration and they are traceable to the World Meteorology Organisation scale. Our system has demonstrated a precision of less than 1 µatm and is accurate, relative to

standard gases, to 2 µatm. Fugacity of CO_2 in the seawater is calculated from the measured xCO_2 (mol fraction of CO_2 gas corrected to dry air and to the pressure of 1 atm).

All samples were taken using the procedures established in the WOCE Operations Manual, WHP Office Report WHPO 91-1/WOCE Report No.68/91.

4.3.2 Preliminary Results

The temperature/salinity diagrams made from the CTD casts (Fig. 14) done for the ESTOC station in October and November 2003 show at intermediate and deeper waters the same trends while on the surface waters slight variations are encountered. The intermediate waters seem to be in equilibrium, since not greater amounts of Mediterranean Water as compared to Antarctic Intermediate Water (AAIW) are found at around 1000 m of depth (8-10°C).

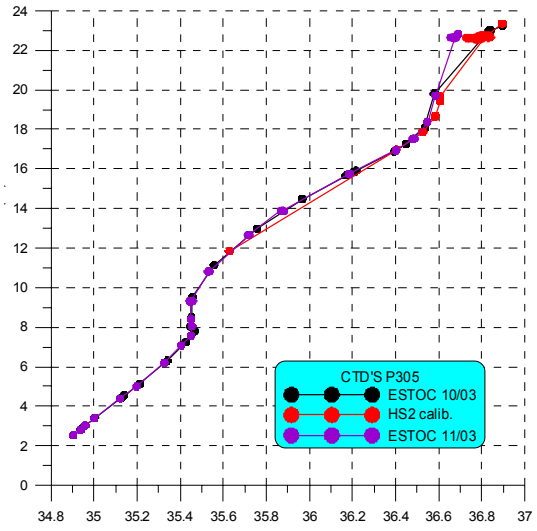


Figure 14: T/S diagrams from CTD stations of R/V POSEIDON cruise 305 at ESTOC (29°10'N, 15°30'W).

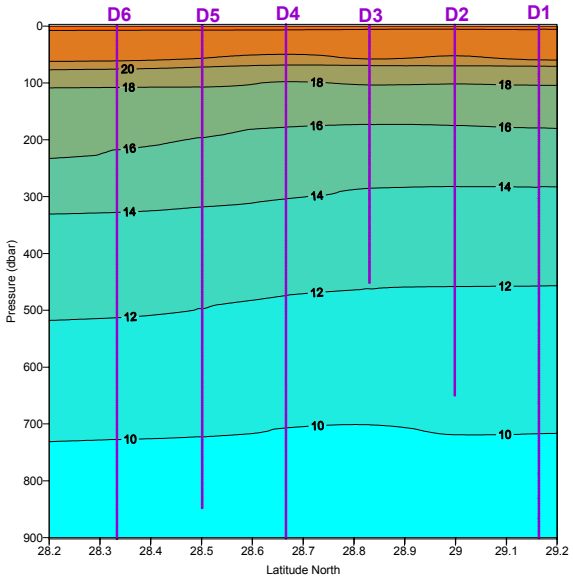
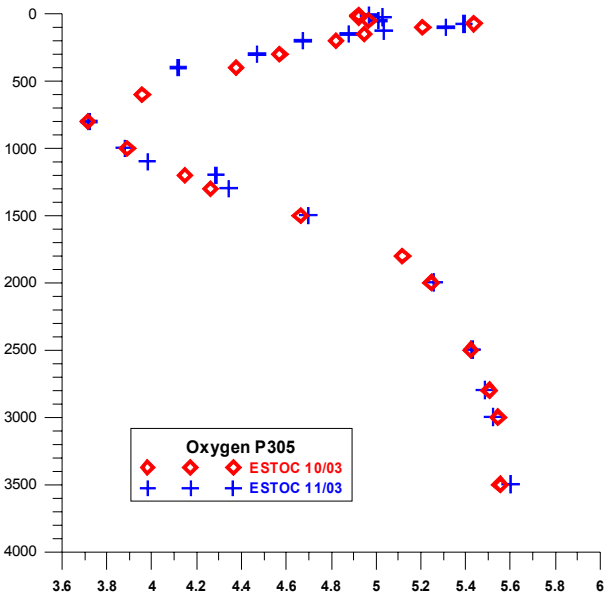


Figure 15: Evolution of the oxygen values from surface to the depth in the stations sampled during R/V POSEIDON cruise 305.

Fig. 15 shows the XBT results stating the variation of the temperature with the latitude as going north from Las Palmas harbour towards the ESTOC station, corresponding from the last XBT launch (D1) to the ESTOC site. Temperature data show a variation from 24°C at the surface to 10°C at around 700 m, having values in the water column which are normal in this area for the autumn season.



Oxygen shows as a general trend in this area of the subtropical North Atlantic with a minimum at around 800-1000 m for the ESTOC station, with values in the range of 3.6-3.8 ml/l.. With increasing depth, Oxygen shows values up to 5.6 ml/l (Fig. 16). A subsurface maximum of about the same value is also encountered.

Figure 16: Temperature variation with latitude from the 6 launches (crosses) made during R/V POSEIDON cruise 305.

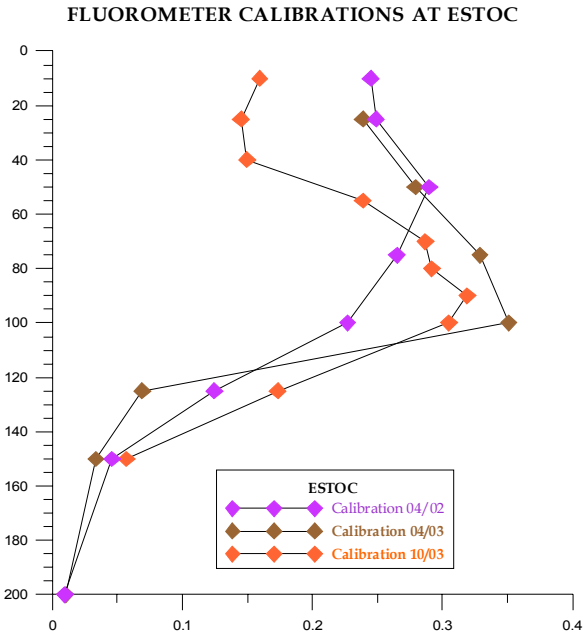


Fig. 17 shows the chlorophyll "a" profiles down to 200 m of nominal depth that were done to calibrate the ANIMATE fluorometer before each mooring deployment period at ESTOC. Values change from year to year even for the same seasonal period (compare 04/02 with 04/03 where the maximum is at different depths and shows a difference of 0.05 micrograms/l). The maximum value for the R/V POSEIDON cruise 305 calibration was found to be 0.32 micrograms/l at 100 m of depth; note that the fluorometer was moored at 90 m at ESTOC during 2003.

Figure 17: It shows the chlorophyll values to calibrate the fluorometer in previous cruises and for R/V POSEIDON cruise 305 at the ANIMATE/ESTOC mooring.

5. List of Stations

Station-No.	date 2003	Discription and Devices	LAT [deg-min]		LONG [deg-min]		WD [m]	Samples	Remarks
	28.10.	XBT #1	28°20,00´	N	015°19,99´	W	3173		
	28.10.	XBT #2	29°30,00´	N	015°19,98´	W	3463		
	28.10.	XBT #3	29°40,00`	N	015°20,00`	W	3584		
	28.10.	XBT #4	29°50,00`	N	015°20,00`	W	3594		
	28.10.	XBT #5	29°00,00`	N	015°20,00`	W	3599		
	28.10.	XBT #6	29°10,00`	N	015°20,00`	W	3598		
	28.10.	CTD/Rosette	29°09,87`	N	015°30,14`	W	3610	12 bottles	
	28.10.	CTD/Rosette	29°10,11`	N	015°30,22`	W	3609	12 bottles	
	29.10.	ACI-2	29°08,00`	N	015°50,00`	W			recovery
	29.10.	DOLAN	29°10,70`	N	015°56,27`	W			recovery
	29.10.	Acoustic test		N		W			
	30.10.	CTD/Rosette	29°10,06`	N	015°30,00`	W	3609	12 bottles	
	30.10.	CTD/Rosette	29°10,09`	N	015°29,94`	W	3609	12 bottles	
	30.10.	CTD/Rosette	29°10,14`	N	015°30,03`	W	3608	12 bottles	
	30.10.	CTD/Rosette	29°10,26`	N	015°29,69`	W	3608	12 bottles	
	30.10.	NOAA drifter	29°10,29`	N	015°29,68`	W			
	30.10.	CTD/Rosette	29°09,62`	N	015°49,92`	W	3625	12 bottles	
	30.10.	CTD/Rosette	29°09,59`	N	015°49,94`	W	3608	12 bottles	
	30.10.	transducer	29°11,05`	N	015°56,32`	W			
	31.10.	Acoustic tests	29°10,89`	N	015°55,97`	W			
	31.10.	DOLAN	29°11,02`	N	015°56,02`	W			deployment
	31.10.	Communication tests	29°10,49`	N	015°55,75`	W			
	31.10.	Acoustic tests	29°10,46`	N	015°55,82`	W			
	01.11.	ACI-3	29°09,59`	N	015°51,05`	W			deployment
	01.11.	DOBS-N	29°10,44`	N	015°55,20`	W	3629		deployment
	02.11.	CTD/Rosette	29°10,01`	N	015°30,06`	W	3609	12 bottles	
	02.11.	CTD/Rosette	29°10,22`	N	015°31,17`	W	3609	12 bottles	
	02.11.	CTD/Rosette	29°10,00`	N	015°30,00`	W	3608	12 bottles	
	02.11.	CTD/Rosette	29°10,05`	N	015°30,11`	W	3608	12 bottles	
	02.11.	MODEM test	29°10,80`	N	015°31,22`	W	3610		

6. Acknowledgements

The scientific cruise participants would like to thank Captain Lutz Mallon and his entire crew for the good cooperation along the R/V POSEIDON cruise 305. The teamwork among the crew and the scientists during the complicated mooring work with the DOLAN data buoy and the ACI steel cable array, leads to the success of this cruise. Due to the friendly way of communication between crew and scientists, we enjoyed ones more the stay onboard the R/V POSEIDON.

7. References

BELLERBY R.G.J., TURNER D.R., MILLWARD G.E. and P.J. WORSFOLD (1995) Shipboard flow injection determination of sea water pH with spectrophotometric detection, *Anal. Chim. Acta*, ***309***, 259-270.

BUTLER J.H., ELKINS C.M., BRUSON C.M., EGAN K.B., THOMPSON T.M., CONWAY T.J. and B.D. HALL (1988) Trace gases in and over the West Pacific and East Indian Oceans during the El Niño-Southern Oscillation event of 1987, NOAA Data Report, ERL-ARL-**16**, 104 pp. Air Resources Laboratory, Silver Spring, Md.

CLAYTON T.D. and R.H. BYRNE (1993) Spectrophotometric seawater pH measurements: total hydrogen ion concentration scale calibration of m-cresol purple and at-sea results, *Deep Sea Res*., ***42***, 411-429.

DETERMANN S., REUTER R., WAGNER P. and R. WILLKOMM (1994) Fluorescent matter in the eastern Atlantic Ocean: Part 1, method of measurement and near-surface distribution, *Deep-Sea Research* **41**, 659-675.

DETERMANN S., REUTER R. and R. WILLKOMM. (1996) Fluorescent matter in the eastern Atlantic Ocean: Part 2, vertical profiles and relation of water masses, *Deep-Sea Research* **43**, 345-360.

DICKSON A.G. (1981) An exact definition of total alkalinity and a procedure for the estimation of alkalinity and total inorganic carbon from titration data, *Deep Sea Res*., ***28***, 609-623.

DICKSON A.G. and C. GOYET (Eds.) (1994) *DOE, Handbook of methods for the analysis of the various parameters of the carbon-dioxide system in sea water*, Version 2, ORNL/CDIAC-74.

DICKSON A.G. and F.J. MILLERO (1987) A comparison of the equilibrium constants for the dissociation of carbonic acid in seawater media, Deep Sea Res. **34**, 1733-1743.

GARSIDE C. (1993) Nitrate reductor efficiency as an error source in seawater analysis, *Mar. Chem*., **4**(1), 25-30.

KOROLEFF F. (1983) Determination of dissolved inorganic phosphate. In Methods of Seawater Analysis. K. Grasshoff, A. Ehrhardt and K. Kremling (eds), Verlag Chemie, 126-129.

KOROLEFF F. (1983b) Determination of dissolved inorganic silicate. In Methods of Seawater Analysis, K. Grasshoff, A. Ehrhardt and K. Kremling (eds), Verlag Chemie, 175-180.

KREMLING K. & A. WENCK (1986) On the storage of dissolved inorganic phosphate, nitrate and reactive silicate in Atlantic Ocean water samples, *Meeresforschung*, **31**, 69-74.

LEE K., MILLERO F.J. and R. WANNINKHOF (1997) The carbon dixodie system in the Atlantic Ocean, *J. Geophys. Res.*, ***102***, 15693-17707.

MCDONALD R.W. & F.A. MCLAUGHLIN (1982) The effect of starege by freeging of disolute inorganic phosphate, nitrate and reactive silicate for samples from coastal and internal water, *Water Research*, **16**, 95-104.

MILLERO F.J. (1995) Thermodynamics of the carbon dioxide system in the oceans, *Geochim. Cosmochim. Acta*, ***59***, 661-677.

MINTROP L.M., PÉREZ F.F., GONZÁLES-DÁVILA M., SANTANA-CASIANO J.M., and A. KÖRTZINGER (2000) Alkalinity determination by potentiometry – intercalibration using three different methods, *Ciencias Marinas*, ***26***, 23-37.

MURPHY J. & J.P. RILEY (1962) A modified single solution method for the determination of phosphate in natural waters, *Anal. Chim. Acta*, **27**, 31-36.

NYDAHL F. (1976) On the optimum conditions for the reduction of nitrate by cadmium, *Talanta*, 23, 349-357.

RILEY J.P. & J.P. SKIRPOW (1975) The Micronutrient Element, *Chemical Oceanography*, **2**, 245-297.

STRICKLAND J.D.H & PARSONs (1972) A practical handbook of seawater analysis, *Fisheries Research Board of Canada*, 167 pp.

UNESCO (1978) Technical Papers in Marine Science, **28**, 35pp.

UNESCO (1984) La escala de salinidades practicas de 1978 y la ecuacion internacional de estado del agua de mar de 1980, Documentos tecnicos de la Unesco sobre Ciencias del Mar, no. **36**.

WANNINKHOF R. and K. THONING (1993) Measurement of fugacity of CO_2 in surface water using continuous and discrete sampling methods, *Mar. Chem*., ***44***, 189-204.

WELSCHMEYER N.A. (1994) Fluorimetric Analysis of Chlorophyll a in presence of Chlorophyll b and Phaeopigments, *Limnol. Oceanog*. **39** (8), 1985-1992.

WOODS E.D., ARMSTRONG F.A.J. & F.A. RICHARDS (1967) Determination of nitrate in seawater by cadmiun-cooper reduction to nitrate, *J. Mar. Biol. Ass. UK.,* **47**, 31-43.

Publications of this series:

No. 1 **Wefer, G., E. Suess and cruise participants**
Bericht über die POLARSTERN-Fahrt ANT IV/2, Rio de Janeiro - Punta Arenas, 6.11. - 1.12.1985.
60 pages, Bremen, 1986.

No. 2 **Hoffmann, G.**
Holozänstratigraphie und Küstenlinienverlagerung an der andalusischen Mittelmeerküste.
173 pages, Bremen, 1988. (out of print)

No. 3 **Wefer, G. and cruise participants**
Bericht über die METEOR-Fahrt M 6/6, Libreville - Las Palmas, 18.2. - 23.3.1988.
97 pages, Bremen, 1988.

No. 4 **Wefer, G., G.F. Lutze, T.J. Müller, O. Pfannkuche, W. Schenke, G. Siedler, W. Zenk**
Kurzbericht über die METEOR-Expedition No. 6, Hamburg - Hamburg, 28.10.1987 - 19.5.1988.
29 pages, Bremen, 1988. (out of print)

No. 5 **Fischer, G.**
Stabile Kohlenstoff-Isotope in partikulärer organischer Substanz aus dem Südpolarmeer (Atlantischer Sektor).
161 pages, Bremen, 1989.

No. 6 **Berger, W.H. and G. Wefer**
Partikelfluß und Kohlenstoffkreislauf im Ozean.
Bericht und Kurzfassungen über den Workshop vom 3.-4. Juli 1989 in Bremen.
57 pages, Bremen, 1989.

No. 7 **Wefer, G. and cruise participants**
Bericht über die METEOR - Fahrt M 9/4, Dakar - Santa Cruz, 19.2. - 16.3.1989.
103 pages, Bremen, 1989.

No. 8 **Kölling, M.**
Modellierung geochemischer Prozesse im Sickerwasser und Grundwasser.
135 pages, Bremen, 1990.

No. 9 **Heinze, P.-M.**
Das Auftriebsgeschehen vor Peru im Spätquartär.
204 pages, Bremen, 1990. (out of print)

No. 10 **Willems, H., G. Wefer, M. Rinski, B. Donner, H.-J. Bellmann, L. Eißmann, A. Müller, B.W. Flemming, H.-C. Höfle, J. Merkt, H. Streif, G. Hertweck, H. Kuntze, J. Schwaar, W. Schäfer, M.-G. Schulz, F. Grube, B. Menke**
Beiträge zur Geologie und Paläontologie Norddeutschlands: Exkursionsführer.
202 pages, Bremen, 1990.

No. 11 **Wefer, G. and cruise participants**
Bericht über die METEOR-Fahrt M 12/1, Kapstadt - Funchal, 13.3.1990 - 14.4.1990.
66 pages, Bremen, 1990.

No. 12 **Dahmke, A., H.D. Schulz, A. Kölling, F. Kracht, A. Lücke**
Schwermetallspuren und geochemische Gleichgewichte zwischen Porenlösung und Sediment im Wesermündungsgebiet. BMFT-Projekt MFU 0562, Abschlußbericht.
121 pages, Bremen, 1991.

No. 13 **Rostek, F.**
Physikalische Strukturen von Tiefseesedimenten des Südatlantiks und ihre Erfassung in Echolotregistrierungen.
209 pages, Bremen, 1991.

No. 14 **Baumann, M.**
Die Ablagerung von Tschernobyl-Radiocäsium in der Norwegischen See und in der Nordsee.
133 pages, Bremen, 1991. (out of print)

No. 15 **Kölling, A.**
Frühdiagenetische Prozesse und Stoff-Flüsse in marinen und ästuarinen Sedimenten.
140 pages, Bremen, 1991.

No. 16 **SFB 261 (ed.)**
1. Kolloquium des Sonderforschungsbereichs 261 der Universität Bremen (14.Juni 1991):
Der Südatlantik im Spätquartär: Rekonstruktion von Stoffhaushalt und Stromsystemen.
Kurzfassungen der Vorträge und Poster.
66 pages, Bremen, 1991.

No. 17 **Pätzold, J. and cruise participants**
Bericht und erste Ergebnisse über die METEOR-Fahrt M 15/2, Rio de Janeiro - Vitoria, 18.1. - 7.2.1991.
46 pages, Bremen, 1993.

No. 18 **Wefer, G. and cruise participants**
Bericht und erste Ergebnisse über die METEOR-Fahrt M 16/1, Pointe Noire - Recife, 27.3. - 25.4.1991.
120 pages, Bremen, 1991.

No. 19 **Schulz, H.D. and cruise participants**
Bericht und erste Ergebnisse über die METEOR-Fahrt M 16/2, Recife - Belem, 28.4. - 20.5.1991.
149 pages, Bremen, 1991.

No. 20 **Berner, H.**
Mechanismen der Sedimentbildung in der Fram-Straße, im Arktischen Ozean und in der Norwegischen See.
167 pages, Bremen, 1991.

No. 21 **Schneider, R.**
Spätquartäre Produktivitätsänderungen im östlichen Angola-Becken: Reaktion auf Variationen im Passat-Monsun-Windsystem und in der Advektion des Benguela-Küstenstroms.
198 pages, Bremen, 1991. (out of print)

No. 22 **Hebbeln, D.**
Spätquartäre Stratigraphie und Paläozeanographie in der Fram-Straße.
174 pages, Bremen, 1991.

No. 23 **Lücke, A.**
Umsetzungsprozesse organischer Substanz während der Frühdiagenese in ästuarinen Sedimenten.
137 pages, Bremen, 1991.

No. 24 **Wefer, G. and cruise participants**
Bericht und erste Ergebnisse der METEOR-Fahrt M 20/1, Bremen - Abidjan, 18.11.- 22.12.1991.
74 pages, Bremen, 1992.

No. 25 **Schulz, H.D. and cruise participants**
Bericht und erste Ergebnisse der METEOR-Fahrt M 20/2, Abidjan - Dakar, 27.12.1991 - 3.2.1992.
173 pages, Bremen, 1992.

No. 26 **Gingele, F.**
Zur klimaabhängigen Bildung biogener und terrigener Sedimente und ihrer Veränderung durch die Frühdiagenese im zentralen und östlichen Südatlantik.
202 pages, Bremen, 1992.

No. 27 **Bickert, T.**
Rekonstruktion der spätquartären Bodenwasserzirkulation im östlichen Südatlantik über stabile Isotope benthischer Foraminiferen. 205 pages, Bremen, 1992. (out of print)

No. 28 **Schmidt, H.**
Der Benguela-Strom im Bereich des Walfisch-Rückens im Spätquartär.
172 pages, Bremen, 1992.

No. 29 **Meinecke, G.**
Spätquartäre Oberflächenwassertemperaturen im östlichen äquatorialen Atlantik.
181 pages, Bremen, 1992.

No. 30 **Bathmann, U., U. Bleil, A. Dahmke, P. Müller, A. Nehrkorn, E.-M. Nöthig, M. Olesch, J. Pätzold, H.D. Schulz, V. Smetacek, V. Spieß, G. Wefer, H. Willems**
Bericht des Graduierten Kollegs. Stoff-Flüsse in marinen Geosystemen.
Berichtszeitraum Oktober 1990 - Dezember 1992.
396 pages, Bremen, 1992.

No. 31 **Damm, E.**
Frühdiagenetische Verteilung von Schwermetallen in Schlicksedimenten der westlichen Ostsee.
115 pages, Bremen, 1992.

No. 32 **Antia, E.E.**
Sedimentology, Morphodynamics and Facies Association of a mesotidal Barrier Island Shoreface (Spiekeroog, Southern North Sea).
370 pages, Bremen, 1993.

No. 33 **Duinker, J. and G. Wefer (ed.)**
Bericht über den 1. JGOFS-Workshop. 1./2. Dezember 1992 in Bremen.
83 pages, Bremen, 1993.

No. 34 **Kasten, S.**
Die Verteilung von Schwermetallen in den Sedimenten eines stadtbremischen Hafenbeckens.
103 pages, Bremen, 1993.

No. 35 **Spieß, V.**
Digitale Sedimentographie. Neue Wege zu einer hochauflösenden Akustostratigraphie.
199 pages, Bremen, 1993.

No. 36 **Schinzel, U.**
Laborversuche zu frühdiagenetischen Reaktionen von Eisen (III) - Oxidhydraten in marinen Sedimenten.
189 pages, Bremen, 1993.

No. 37 **Sieger, R.**
CoTAM - ein Modell zur Modellierung des Schwermetalltransports in Grundwasserleitern.
56 pages, Bremen, 1993. (out of print)

No. 38 **Willems, H. (ed.)**
Geoscientific Investigations in the Tethyan Himalayas. 183 pages, Bremen, 1993.

No. 39 **Hamer, K.**
Entwicklung von Laborversuchen als Grundlage für die Modellierung des Transportverhaltens von Arsenat, Blei, Cadmium und Kupfer in wassergesättigten Säulen.
147 pages, Bremen, 1993.

No. 40 **Sieger, R.**
Modellierung des Stofftransports in porösen Medien unter Ankopplung kinetisch gesteuerter Sorptions- und Redoxprozesse sowie thermischer Gleichgewichte.
158 pages, Bremen, 1993.

No. 41 **Thießen, W.**
Magnetische Eigenschaften von Sedimenten des östlichen Südatlantiks und ihre paläozeanographische Relevanz.
170 pages, Bremen, 1993.

No. 42 **Spieß, V. and cruise participants**
Report and preliminary results of METEOR-Cruise M 23/1, Kapstadt - Rio de Janeiro, 4.-25.2.1993.
139 pages, Bremen, 1994.

No. 43 **Bleil, U. and cruise participants**
Report and preliminary results of METEOR-Cruise M 23/2, Rio de Janeiro - Recife, 27.2.-19.3.1993
133 pages, Bremen, 1994.

No. 44 **Wefer, G. and cruise participants**
Report and preliminary results of METEOR-Cruise M 23/3, Recife - Las Palmas, 21.3. - 12.4.1993
71 pages, Bremen, 1994.

No. 45 **Giese, M. and G. Wefer (ed.)**
Bericht über den 2. JGOFS-Workshop. 18../19. November 1993 in Bremen.
93 pages, Bremen, 1994.

No. 46 **Balzer, W. and cruise participants**
Report and preliminary results of METEOR-Cruise M 22/1, Hamburg - Recife, 22.9. - 21.10.1992.
24 pages, Bremen, 1994.

No. 47 **Stax, R.**
Zyklische Sedimentation von organischem Kohlenstoff in der Japan See: Anzeiger für Änderungen von Paläoozeanographie und Paläoklima im Spätkänozoikum.
150 pages, Bremen, 1994.

No. 48 **Skowronek, F.**
Frühdiagenetische Stoff-Flüsse gelöster Schwermetalle an der Oberfläche von Sedimenten des Weser Ästuares.
107 pages, Bremen, 1994.

No. 49 **Dersch-Hansmann, M.**
Zur Klimaentwicklung in Ostasien während der letzten 5 Millionen Jahre: Terrigener Sedimenteintrag in die Japan See (ODP Ausfahrt 128).
149 pages, Bremen, 1994.

No. 50 **Zabel, M.**
Frühdiagenetische Stoff-Flüsse in Oberflächen-Sedimenten des äquatorialen und östlichen Südatlantik.
129 pages, Bremen, 1994.

No. 51 **Bleil, U. and cruise participants**
Report and preliminary results of SONNE-Cruise SO 86, Buenos Aires - Capetown, 22.4. - 31.5.93
116 pages, Bremen, 1994.

No. 52 **Symposium: The South Atlantic: Present and Past Circulation.**
Bremen, Germany, 15 - 19 August 1994. Abstracts.
167 pages, Bremen, 1994.

No. 53 **Kretzmann, U.B.**
^{57}Fe-Mössbauer-Spektroskopie an Sedimenten - Möglichkeiten und Grenzen.
183 pages, Bremen, 1994.

No. 54 **Bachmann, M.**
Die Karbonatrampe von Organyà im oberen Oberapt und unteren Unteralb (NE-Spanien, Prov. Lerida): Fazies, Zyklo- und Sequenzstratigraphie.
147 pages, Bremen, 1994. (out of print)

No. 55 **Kemle-von Mücke, S.**
Oberflächenwasserstruktur und -zirkulation des Südostatlantiks im Spätquartär.
151 pages, Bremen, 1994.

No. 56 **Petermann, H.**
Magnetotaktische Bakterien und ihre Magnetosome in Oberflächensedimenten des Südatlantiks.
134 pages, Bremen, 1994.

No. 57 **Mulitza, S.**
Spätquartäre Variationen der oberflächennahen Hydrographie im westlichen äquatorialen Atlantik.
97 pages, Bremen, 1994.

No. 58 **Segl, M. and cruise participants**
Report and preliminary results of METEOR-Cruise M 29/1, Buenos-Aires - Montevideo, 17.6. - 13.7.1994
94 pages, Bremen, 1994.

No. 59 **Bleil, U. and cruise participants**
Report and preliminary results of METEOR-Cruise M 29/2, Montevideo - Rio de Janiero 15.7. - 8.8.1994.
153 pages, Bremen, 1994.

No. 60 **Henrich, R. and cruise participants**
Report and preliminary results of METEOR-Cruise M 29/3, Rio de Janeiro - Las Palmas 11.8. - 5.9.1994. Bremen,
1994. (out of print)

No. 61 **Sagemann, J.**
Saisonale Variationen von Porenwasserprofilen, Nährstoff-Flüssen und Reaktionen in intertidalen Sedimenten des Weser-Ästuars.
110 pages, Bremen, 1994. (out of print)

No. 62 **Giese, M. and G. Wefer**
Bericht über den 3. JGOFS-Workshop. 5./6. Dezember 1994 in Bremen.
84 pages, Bremen, 1995.

No. 63 **Mann, U.**
Genese kretazischer Schwarzschiefer in Kolumbien: Globale vs. regionale/lokale Prozesse.
153 pages, Bremen, 1995. (out of print)

No. 64 **Willems, H., Wan X., Yin J., Dongdui L., Liu G., S. Dürr, K.-U. Gräfe**
The Mesozoic development of the N-Indian passive margin and of the Xigaze Forearc Basin in southern Tibet, China. – Excursion Guide to IGCP 362 Working-Group Meeting "Integrated Stratigraphy".
113 pages, Bremen, 1995. (out of print)

No. 65 **Hünken, U.**
Liefergebiets - Charakterisierung proterozoischer Goldseifen in Ghana anhand von Fluideinschluß-Untersuchungen.
270 pages, Bremen, 1995.

No. 66 **Nyandwi, N.**
The Nature of the Sediment Distribution Patterns in ther Spiekeroog Backbarrier Area, the East Frisian Islands.
162 pages, Bremen, 1995.

No. 67 **Isenbeck-Schröter, M.**
Transportverhalten von Schwermetallkationen und Oxoanionen in wassergesättigten Sanden. - Laborversuche in Säulen und ihre Modellierung -.
182 pages, Bremen, 1995.

No. 68 **Hebbeln, D. and cruise participants**
Report and preliminary results of SONNE-Cruise SO 102, Valparaiso - Valparaiso, 95
134 pages, Bremen, 1995.

No. 69 **Willems, H. (Sprecher), U.Bathmann, U. Bleil, T. v. Dobeneck, K. Herterich, B.B. Jorgensen, E.-M. Nöthig, M. Olesch, J. Pätzold, H.D. Schulz, V. Smetacek, V. Speiß. G. Wefer**
Bericht des Graduierten-Kollegs Stoff-Flüsse in marine Geosystemen.
Berichtszeitraum Januar 1993 - Dezember 1995.
45 & 468 pages, Bremen, 1995.

No. 70 **Giese, M. and G. Wefer**
Bericht über den 4. JGOFS-Workshop. 20./21. November 1995 in Bremen.
60 pages, Bremen, 1996. (out of print)

No. 71 **Meggers, H.**
Pliozän-quartäre Karbonatsedimentation und Paläozeanographie des Nordatlantiks und des Europäischen Nordmeeres - Hinweise aus planktischen Foraminiferengemeinschaften.
143 pages, Bremen, 1996. (out of print)

No. 72 **Teske, A.**
Phylogenetische und ökologische Untersuchungen an Bakterien des oxidativen und reduktiven marinen Schwefelkreislaufs mittels ribosomaler RNA.
220 pages, Bremen, 1996. (out of print)

No. 73 **Andersen, N.**
Biogeochemische Charakterisierung von Sinkstoffen und Sedimenten aus ostatlantischen Produktions-Systemen mit Hilfe von Biomarkern.
215 pages, Bremen, 1996.

No. 74 **Treppke, U.**
Saisonalität im Diatomeen- und Silikoflagellatenfluß im östlichen tropischen und subtropischen Atlantik.
200 pages, Bremen, 1996.

No. 75 **Schüring, J.**
Die Verwendung von Steinkohlebergematerialien im Deponiebau im Hinblick auf die Pyritverwitterung und die Eignung als geochemische Barriere.
110 pages, Bremen, 1996.

No. 76 **Pätzold, J. and cruise participants**
Report and preliminary results of VICTOR HENSEN cruise JOPS II, Leg 6,
Fortaleza - Recife, 10.3. - 26.3. 1995 and Leg 8, Vítoria - Vítoria, 10.4. - 23.4.1995.
87 pages, Bremen, 1996.

No. 77 **Bleil, U. and cruise participants**
Report and preliminary results of METEOR-Cruise M 34/1, Cape Town - Walvis Bay, 3.-26.1.1996.
129 pages, Bremen, 1996.

No. 78 **Schulz, H.D. and cruise participants**
Report and preliminary results of METEOR-Cruise M 34/2, Walvis Bay - Walvis Bay, 29.1.-18.2.96
133 pages, Bremen, 1996.

No. 79 **Wefer, G. and cruise participants**
Report and preliminary results of METEOR-Cruise M 34/3, Walvis Bay - Recife, 21.2.-17.3.1996.
168 pages, Bremen, 1996.

No. 80 **Fischer, G. and cruise participants**
Report and preliminary results of METEOR-Cruise M 34/4, Recife - Bridgetown, 19.3.-15.4.1996.
105 pages, Bremen, 1996.

No. 81 **Kulbrok, F.**
Biostratigraphie, Fazies und Sequenzstratigraphie einer Karbonatrampe in den Schichten der Oberkreide und des Alttertiärs Nordost-Ägyptens (Eastern Desert, N'Golf von Suez, Sinai).
153 pages, Bremen, 1996.

No. 82 **Kasten, S.**
Early Diagenetic Metal Enrichments in Marine Sediments as Documents of Nonsteady-State Depositional Conditions. Bremen, 1996.

No. 83 **Holmes, M.E.**
Reconstruction of Surface Ocean Nitrate Utilization in the Southeast Atlantic Ocean Based on Stable Nitrogen Isotopes.
113 pages, Bremen, 1996.

No. 84 **Rühlemann, C.**
Akkumulation von Carbonat und organischem Kohlenstoff im tropischen Atlantik: Spätquartäre Produktivitäts-Variationen und ihre Steuerungsmechanismen.
139 pages, Bremen, 1996.

No. 85 **Ratmeyer, V.**
Untersuchungen zum Eintrag und Transport lithogener und organischer partikulärer Substanz im östlichen subtropischen Nordatlantik.
154 pages, Bremen, 1996.

No. 86 **Cepek, M.**
Zeitliche und räumliche Variationen von Coccolithophoriden-Gemeinschaften im subtropischen Ost-Atlantik: Untersuchungen an Plankton, Sinkstoffen und Sedimenten.
156 pages, Bremen, 1996.

No. 87 **Otto, S.**
Die Bedeutung von gelöstem organischen Kohlenstoff (DOC) für den Kohlenstoffffluß im Ozean.
150 pages, Bremen, 1996.

No. 88 **Hensen, C.**
Frühdiagenetische Prozesse und Quantifizierung benthischer Stoff-Flüsse in Oberflächensedimenten des Südatlantiks.
132 pages, Bremen, 1996.

No. 89 **Giese, M. and G. Wefer**
Bericht über den 5. JGOFS-Workshop. 27./28. November 1996 in Bremen.
73 pages, Bremen, 1997.

No. 90 **Wefer, G. and cruise participants**
Report and preliminary results of METEOR-Cruise M 37/1, Lisbon - Las Palmas, 4.-23.12.1996.
79 pages, Bremen, 1997.

No. 91 **Isenbeck-Schröter, M., E. Bedbur, M. Kofod, B. König, T. Schramm & G. Mattheß**
Occurrence of Pesticide Residues in Water - Assessment of the Current Situation in Selected EU Countries.
65 pages, Bremen 1997.

No. 92 **Kühn, M.**
Geochemische Folgereaktionen bei der hydrogeothermalen Energiegewinnung.
129 pages, Bremen 1997.

No. 93 **Determann, S. & K. Herterich**
JGOFS-A6 “Daten und Modelle”: Sammlung JGOFS-relevanter Modelle in Deutschland.
26 pages, Bremen, 1997.

No. 94 **Fischer, G. and cruise participants**
Report and preliminary results of METEOR-Cruise M 38/1, Las Palmas - Recife, 25.1.-1.3.1997, with Appendix: Core Descriptions from METEOR Cruise M 37/1. Bremen, 1997.

No. 95 **Bleil, U. and cruise participants**
Report and preliminary results of METEOR-Cruise M 38/2, Recife - Las Palmas, 4.3.-14.4.1997.
126 pages, Bremen, 1997.

No. 96 **Neuer, S. and cruise participants**
Report and preliminary results of VICTOR HENSEN-Cruise 96/1. Bremen, 1997.

No. 97 **Villinger, H. and cruise participants**
Fahrtbericht SO 111, 20.8. - 16.9.1996. 115 pages, Bremen, 1997.

No. 98 **Lüning, S.**
Late Cretaceous - Early Tertiary sequence stratigraphy, paleoecology and geodynamics of Eastern Sinai, Egypt.
218 pages, Bremen, 1997.

No. 99 **Haese, R.R.**
Beschreibung und Quantifizierung frühdiagenetischer Reaktionen des Eisens in Sedimenten des Südatlantiks.
118 pages, Bremen, 1997.

No. 100 **Lührte, R. von**
Verwertung von Bremer Baggergut als Material zur Oberflächenabdichtung von Deponien - Geochemisches Langzeitverhalten und Schwermetall-Mobilität (Cd, Cu, Ni, Pb, Zn).
Bremen, 1997.

No. 101 **Ebert, M.**
Der Einfluß des Redoxmilieus auf die Mobilität von Chrom im durchströmten Aquifer.
135 pages, Bremen, 1997.

No. 102 **Krögel, F.**
Einfluß von Viskosität und Dichte des Seewassers auf Transport und Ablagerung von Wattsedimenten (Langeooger Rückseitenwatt, südliche Nordsee).
168 pages, Bremen, 1997.

No. 103 **Kerntopf, B.**
Dinoflagellate Distribution Patterns and Preservation in the Equatorial Atlantic and Offshore North-West Africa.
137 pages, Bremen, 1997.

No. 104 **Breitzke, M.**
Elastische Wellenausbreitung in marinen Sedimenten - Neue Entwicklungen der Ultraschall Sedimentphysik und Sedimentechographie.
298 pages, Bremen, 1997.

No. 105 **Marchant, M.**
Rezente und spätquartäre Sedimentation planktischer Foraminiferen im Peru-Chile Strom.
115 pages, Bremen, 1997.

No. 106 **Habicht, K.S.**
Sulfur isotope fractionation in marine sediments and bacterial cultures.
125 pages, Bremen, 1997.

No. 107 **Hamer, K., R.v. Lührte, G. Becker, T. Felis, S. Keffel, B. Strotmann, C. Waschkowitz, M. Kölling, M. Isenbeck-Schröter, H.D. Schulz**
Endbericht zum Forschungsvorhaben 060 des Landes Bremen: Baggergut der Hafengruppe Bremen-Stadt: Modelluntersuchungen zur Schwermetallmobilität und Möglichkeiten der Verwertung von Hafenschlick aus Bremischen Häfen.
98 pages, Bremen, 1997.

No. 108 **Greeff, O.W.**
Entwicklung und Erprobung eines benthischen Landersystemes zur *in situ*-Bestimmung von Sulfatreduktionsraten mariner Sedimente.
121 pages, Bremen, 1997.

No. 109 **Pätzold, M. und G. Wefer**
Bericht über den 6. JGOFS-Workshop am 4./5.12.1997 in Bremen. Im Anhang:
Publikationen zum deutschen Beitrag zur Joint Global Ocean Flux Study (JGOFS), Stand 1/1998.
122 pages, Bremen, 1998.

No. 110 **Landenberger, H.**
CoTReM, ein Multi-Komponenten Transport- und Reaktions-Modell. 142 pages, Bremen, 1998.

No. 111 **Villinger, H. und Fahrtteilnehmer**
Fahrtbericht SO 124, 4.10. - 16.10.199.
90 pages, Bremen, 1997.

No. 112 **Gietl, R.**
Biostratigraphie und Sedimentationsmuster einer nordostägyptischen Karbonatrampe unter Berücksichtigung der Alveolinen-Faunen.
142 pages, Bremen, 1998.

No. 113 **Ziebis, W.**
The Impact of the Thalassinidean Shrimp *Callianassa truncata* on the Geochemistry of permeable, coastal Sediments.
158 pages, Bremen 1998.

No. 114 **Schulz, H.D. and cruise participants**
Report and preliminary results of METEOR-Cruise M 41/1, Málaga - Libreville, 13.2.-15.3.1998.
Bremen, 1998.

No. 115 **Völker, D.J.**
Untersuchungen an strömungsbeeinflußten Sedimentationsmustern im Südozean. Interpretation sedimentechographischer Daten und numerische Modellierung.
152 pages, Bremen, 1998.

No. 116 **Schlünz, B.**
Riverine Organic Carbon Input into the Ocean in Relation to Late Quaternary Climate Change.
136 pages, Bremen, 1998.

No. 117 **Kuhnert, H.**
Aufzeichnug des Klimas vor Westaustralien in stabilen Isotopen in Korallenskeletten.
109 pages, Bremen, 1998.

No. 118 **Kirst, G.**
Rekonstruktion von Oberflächenwassertemperaturen im östlichen Südatlantik anhand von Alkenonen.
130 pages, Bremen, 1998.

No. 119 **Dürkoop, A.**
Der Brasil-Strom im Spätquartär: Rekonstruktion der oberflächennahen Hydrographie während der letzten 400 000 Jahre.
121 pages, Bremen, 1998.

No. 120 **Lamy, F.**
Spätquartäre Variationen des terrigenen Sedimenteintrags entlang des chilenischen Kontinentalhangs als Abbild von Klimavariabilität im Milankovi- und Sub-Milankovi-Zeitbereich.
141 pages, Bremen, 1998.

No. 121 **Neuer, S. and cruise participants**
Report and preliminary results of POSEIDON-Cruise Pos 237/2, Vigo – Las Palmas, 18.3.-31.3.1998.
39 pages, Bremen, 1998

No. 122 **Romero, O.E.**
Marine planktonic diatoms from the tropical and equatorial Atlantic: temporal flux patterns and the sediment record.
205 pages, Bremen, 1998.

No. 123 **Spiess, V. und Fahrtteilnehmer**
Report and preliminary results of RV SONNE Cruise 125, Cochin – Chittagong, 17.10.-17.11.1997.
128 pages, Bremen, 1998.

No. 124 **Arz, H.W.**
Dokumentation von kurzfristigen Klimaschwankungen des Spätquartärs in Sedimenten des westlichen äquatorialen Atlantiks.
96 pages, Bremen, 1998.

No. 125 **Wolff, T.**
Mixed layer characteristics in the equatorial Atlantic during the late Quaternary as deduced from planktonic foraminifera.
132 pages, Bremen, 1998.

No. 126 **Dittert, N.**
Late Quaternary Planktic Foraminifera Assemblages in the South Atlantic Ocean: Quantitative Determination and Preservational Aspects.
165 pages, Bremen, 1998.

No. 127 **Höll, C.**
Kalkige und organisch-wandige Dinoflagellaten-Zysten in Spätquartären Sedimenten des tropischen Atlantiks und ihre palökologische Auswertbarkeit.
121 pages, Bremen, 1998.

No. 128 **Hencke, J.**
Redoxreaktionen im Grundwasser: Etablierung und Verlagerung von Reaktionsfronten und ihre Bedeutung für die Spurenelement-Mobilität.
122 pages, Bremen 1998.

No. 129 **Pätzold, J. and cruise participants**
Report and preliminary results of METEOR-Cruise M 41/3, Vítoria, Brasil – Salvador de Bahia, Brasil, 18.4. - 15.5.1998. Bremen, 1999.

No. 130 **Fischer, G. and cruise participants**
Report and preliminary results of METEOR-Cruise M 41/4, Salvador de Bahia, Brasil – Las Palmas, Spain, 18.5. – 13.6.1998. Bremen, 1999.

No. 131 **Schlünz, B. und G. Wefer**
Bericht über den 7. JGOFS-Workshop am 3. und 4.12.1998 in Bremen. Im Anhang: Publikationen zum deutschen Beitrag zur Joint Global Ocean Flux Study (JGOFS), Stand 1/ 1999.
100 pages, Bremen, 1999.

No. 132 **Wefer, G. and cruise participants**
Report and preliminary results of METEOR-Cruise M 42/4, Las Palmas - Las Palmas - Viena do Castelo; 26.09.1998 - 26.10.1998.
104 pages, Bremen, 1999.

No. 133 **Felis, T.**
Climate and ocean variability reconstructed from stable isotope records of modern subtropical corals (Northern Red Sea).
111 pages, Bremen, 1999.

No. 134 **Draschba, S.**
North Atlantic climate variability recorded in reef corals from Bermuda.
108 pages, Bremen, 1999.

No. 135 **Schmieder, F.**
Magnetic Cyclostratigraphy of South Atlantic Sediments.
82 pages, Bremen, 1999.

No. 136 **Rieß, W.**
In situ measurements of respiration and mineralisation processes – Interaction between fauna and geochemical fluxes at active interfaces.
68 pages, Bremen, 1999.

No. 137 **Devey, C.W. and cruise participants**
Report and shipboard results from METEOR-cruise M 41/2, Libreville – Vitoria, 18.3. – 15.4.98.
59 pages, Bremen, 1999.

No. 138 **Wenzhöfer, F.**
Biogeochemical processes at the sediment water interface and quantification of metabolically driven calcite dissolution in deep sea sediments.
103 pages, Bremen, 1999.

No. 139 **Klump, J.**
Biogenic barite as a proxy of paleoproductivity variations in the Southern Peru-Chile Current.
107 pages, Bremen, 1999.

No. 140 **Huber, R.**
Carbonate sedimentation in the northern Northatlantic since the late pliocene.
103 pages, Bremen, 1999.

No. 141 **Schulz, H.**
Nitrate-storing sulfur bacteria in sediments of coastal upwelling.
94 pages, Bremen, 1999.

No. 142 **Mai, S.**
Die Sedimentverteilung im Wattenmeer: ein Simulationsmodell.
114 pages, Bremen, 1999.

No. 143 **Neuer, S. and cruise participants**
Report and preliminary results of Poseidon Cruise 248, Las Palmas - Las Palmas, 15.2.-26.2.1999.
45 pages, Bremen, 1999.

No. 144 **Weber, A.**
Schwefelkreislauf in marinen Sedimenten und Messung von *in situ* Sulfatreduktionsraten.
122 pages, Bremen, 1999.

No. 145 **Hadeler, A.**
Sorptionsreaktionen im Grundwasser: Unterschiedliche Aspekte bei der Modellierung des Transportverhaltens von Zink.
122 pages, 1999.

No. 146 **Dierßen, H.**
Zum Kreislauf ausgewählter Spurenmetalle im Südatlantik: Vertikaltransport und Wechselwirkung zwischen Partikeln und Lösung.
167 pages, Bremen, 1999.

No. 147 **Zühlsdorff, L.**
High resolution multi-frequency seismic surveys at the Eastern Juan de Fuca Ridge Flank and the Cascadia Margin – Evidence for thermally and tectonically driven fluid upflow in marine sediments.
118 pages, Bremen 1999.

No. 148 **Kinkel, H.**
Living and late Quaternary Coccolithophores in the equatorial Atlantic Ocean: response of distribution and productivity patterns to changing surface water circulation.
183 pages, Bremen, 2000.

No. 149 **Pätzold, J. and cruise participants**
Report and preliminary results of METEOR Cruise M 44/3, Aqaba (Jordan) - Safaga (Egypt) – Dubá
(Saudi Arabia) – Suez (Egypt) - Haifa (Israel), 12.3.-26.3.-2.4.-4.4.1999. 1
35 pages, Bremen, 2000.

No. 150 **Schlünz, B. and G. Wefer**
Bericht über den 8. JGOFS-Workshop am 2. und 3.12.1999 in Bremen. Im Anhang:
Publikationen zum deutschen Beitrag zur Joint Global Ocean Flux Study (JGOFS), Stand 1/ 2000.
95 pages, Bremen, 2000.

No. 151 **Schnack, K.**
Biostratigraphie und fazielle Entwicklung in der Oberkreide und im Alttertiär im Bereich der Kharga Schwelle, Westliche Wüste, SW-Ägypten.
142 pages, Bremen, 2000.

No. 152 **Karwath, B.**
Ecological studies on living and fossil calcareous dinoflagellates of the equatorial and tropical Atlantic Ocean.
175 pages, Bremen, 2000.

No. 153 **Moustafa, Y.**
Paleoclimatic reconstructions of the Northern Red Sea during the Holocene inferred from stable isotope records of modern and fossil corals and molluscs.
102 pages, Bremen, 2000.

No. 154 **Villinger, H. and cruise participants**
Report and preliminary results of SONNE-cruise 145-1 Balboa – Talcahuana, 21.12.1999 – 28.01.2000.
147 pages, Bremen, 2000.

No. 155 **Rusch, A.**
Dynamik der Feinfraktion im Oberflächenhorizont permeabler Schelfsedimente.
102 pages, Bremen, 2000.

No. 156 **Moos, C.**
Reconstruction of upwelling intensity and paleo-nutrient gradients in the northwest Arabian Sea derived from stable carbon and oxygen isotopes of planktic foraminifera.
103 pages, Bremen, 2000.

No. 157 **Xu, W.**
Mass physical sediment properties and trends in a Wadden Sea tidal basin.
127 pages, Bremen, 2000.

No. 158 **Meinecke, G. and cruise participants**
Report and preliminary results of METEOR Cruise M 45/1, Malaga (Spain) - Lissabon (Portugal), 19.05. - 08.06.1999.
39 pages, Bremen, 2000.

No. 159 **Vink, A.**
Reconstruction of recent and late Quaternary surface water masses of the western subtropical Atlantic Ocean based on calcareous and organic-walled dinoflagellate cysts.
160 pages, Bremen, 2000.

No. 160 **Willems, H. (Sprecher), U. Bleil, R. Henrich, K. Herterich, B.B. Jørgensen, H.-J. Kuß, M. Olesch, H.D. Schulz,V. Spieß, G. Wefer**
Abschlußbericht des Graduierten-Kollegs Stoff-Flüsse in marine Geosystemen.
Zusammenfassung und Berichtszeitraum Januar 1996 - Dezember 2000.
340 pages, Bremen, 2000.

No. 161 **Sprengel, C.**
Untersuchungen zur Sedimentation und Ökologie von Coccolithophoriden im Bereich der Kanarischen Inseln: Saisonale Flussmuster und Karbonatexport.
165 pages, Bremen, 2000.

No. 162 **Donner, B. and G. Wefer**
Bericht über den JGOFS-Workshop am 18.-21.9.2000 in Bremen:
Biogeochemical Cycles: German Contributions to the International Joint Global Ocean Flux Study.
87 pages, Bremen, 2000.

No. 163 **Neuer, S. and cruise participants**
Report and preliminary results of Meteor Cruise M 45/5, Bremen – Las Palmas, October 1 – November 3, 1999.
93 pages, Bremen, 2000.

No. 164 **Devey, C. and cruise participants**
Report and preliminary results of Sonne Cruise SO 145/2, Talcahuano (Chile) - Arica (Chile), February 4 – February 29, 2000.
63 pages, Bremen, 2000.

No. 165 **Freudenthal, T.**
Reconstruction of productivity gradients in the Canary Islands region off Morocco by means of sinking particles and sediments.
147 pages, Bremen, 2000.

No. 166 **Adler, M.**
Modeling of one-dimensional transport in porous media with respect to simultaneous geochemical reactions in CoTReM.
147 pages, Bremen, 2000.

No. 167 **Santamarina Cuneo, P.**
Fluxes of suspended particulate matter through a tidal inlet of the East Frisian Wadden Sea (southern North Sea).
91 pages, Bremen, 2000.

No. 168 **Benthien, A.**
Effects of CO2 and nutrient concentration on the stable carbon isotope composition of C37:2 alkenones in sediments of the South Atlantic Ocean.
104 pages, Bremen, 2001.

No. 169 **Lavik, G.**
Nitrogen isotopes of sinking matter and sediments in the South Atlantic.
140 pages, Bremen, 2001.

No. 170 **Budziak, D.**
Late Quaternary monsoonal climate and related variations in paleoproductivity and alkenone-derived sea-surface temperatures in the western Arabian Sea.
114 pages, Bremen, 2001.

No. 171 **Gerhardt, S.**
Late Quaternary water mass variability derived from the pteropod preservation state in sediments of the western South Atlantic Ocean and the Caribbean Sea.
109 pages, Bremen, 2001.

No. 172 **Bleil, U. and cruise participants**
Report and preliminary results of Meteor Cruise M 46/3, Montevideo (Uruguay) – Mar del Plata (Argentina), January 4 – February 7, 2000. Bremen, 2001.

No. 173 **Wefer, G. and cruise participants**
Report and preliminary results of Meteor Cruise M 46/4, Mar del Plata (Argentina) – Salvador da Bahia (Brazil), February 10 – March 13, 2000. With partial results of METEOR cruise M 46/2.
136 pages, Bremen, 2001.

No. 174 **Schulz, H.D. and cruise participants**
Report and preliminary results of Meteor Cruise M 46/2, Recife (Brazil) – Montevideo (Uruguay), December 2 – December 29, 1999.
107 pages, Bremen, 2001.

No. 175 **Schmidt, A.**
Magnetic mineral fluxes in the Quaternary South Atlantic: Implications for the paleoenvironment.
97 pages, Bremen, 2001.

No. 176 **Bruhns, P.**
Crystal chemical characterization of heavy metal incorporation in brick burning processes.
93 pages, Bremen, 2001.

No. 177 **Karius, V.**
Baggergut der Hafengruppe Bremen-Stadt in der Ziegelherstellung.
131 pages, Bremen, 2001.

No. 178 **Adegbie, A. T.**
Reconstruction of paleoenvironmental conditions in Equatorial Atlantic and the Gulf of Guinea Basins for the last 245,000 years.
113 pages, Bremen, 2001.

No. 179 **Spieß, V. and cruise participants**
Report and preliminary results of R/V Sonne Cruise SO 149, Victoria - Victoria, 16.8. - 16.9.2000.
100 pages, Bremen, 2001.

No. 180 **Kim, J.-H.**
Reconstruction of past sea-surface temperatures in the eastern South Atlantic and the eastern South Pacific across Termination I based on the Alkenone Method.
114 pages, Bremen, 2001.

No. 181 **von Lom-Keil, H.**
Sedimentary waves on the Namibian continental margin and in the Argentine Basin – Bottom flow reconstructions based on high resolution echosounder data.
126 pages, Bremen, 2001.

No. 182 **Hebbeln, D. and cruise participants**
PUCK: Report and preliminary results of R/V Sonne Cruise SO 156, Valparaiso (Chile) - Talcahuano (Chile), March 29 - May 14, 2001.
195 pages, Bremen, 2001.

No. 183 **Wendler, J.**
Reconstruction of astronomically-forced cyclic and abrupt paleoecological changes in the Upper Cretaceous Boreal Realm based on calcareous dinoflagellate cysts.
149 pages, Bremen, 2001.

No. 184 **Volbers, A.**
Planktic foraminifera as paleoceanographic indicators: production, preservation, and reconstruction of upwelling intensity. Implications from late Quaternary South Atlantic sediments.
122 pages, Bremen, 2001.

No. 185 **Bleil, U. and cruise participants**
Report and preliminary results of R/V METEOR Cruise M 49/3, Montevideo (Uruguay) - Salvador (Brasil), March 9 - April 1, 2001.
99 pages, Bremen, 2001.

No. 186 **Scheibner, C.**
Architecture of a carbonate platform-to-basin transition on a structural high (Campanian-early Eocene, Eastern Desert, Egypt) – classical and modelling approaches combined.
173 pages, Bremen, 2001.

No. 187 **Schneider, S.**
Quartäre Schwankungen in Strömungsintensität und Produktivität als Abbild der Wassermassen-Variabilität im äquatorialen Atlantik (ODP Sites 959 und 663): Ergebnisse aus Siltkorn-Analysen.
134 pages, Bremen, 2001.

No. 188 **Uliana, E.**
Late Quaternary biogenic opal sedimentation in diatom assemblages in Kongo Fan sediments.
96 pages, Bremen, 2002.

No. 189 **Esper, O.**
Reconstruction of Recent and Late Quaternary oceanographic conditions in the eastern South Atlantic Ocean based on calcareous- and organic-walled dinoflagellate cysts.
130 pages, Bremen, 2001.

No. 190 **Wendler, I.**
Production and preservation of calcareous dinoflagellate cysts in the modern Arabian Sea.
117 pages, Bremen, 2002.

No. 191 **Bauer, J.**
Late Cenomanian – Santonian carbonate platform evolution of Sinai (Egypt): stratigraphy, facies, and sequence architecture.
178 pages, Bremen, 2002.

No. 192 **Hildebrand-Habel, T.**
Die Entwicklung kalkiger Dinoflagellaten im Südatlantik seit der höheren Oberkreide. 152 pages, Bremen, 2002.

No. 193 **Hecht, H.**
Sauerstoff-Optopoden zur Quantifizierung von Pyritverwitterungsprozessen im Labor- und Langzeit-in-situ-Einsatz. Entwicklung - Anwendung – Modellierung.
130 pages, Bremen, 2002.

No. 194 **Fischer, G. and cruise participants**
Report and Preliminary Results of RV METEOR-Cruise M49/4, Salvador da Bahia – Halifax, 4.4.-5.5.2001.
84 pages, Bremen, 2002.

No. 195 **Gröger, M.**
Deep-water circulation in the western equatorial Atlantic: inferences from carbonate preservation studies and silt grain-size analysis.
95 pages, Bremen, 2002.

No. 196 **Meinecke,G. and cruise participants**
Report of RV POSEIDON Cruise POS 271, Las Palmas - Las Palmas, 19.3.-29.3.2001.
19 pages, Bremen, 2002.

No. 197 **Meggers, H. and cruise participants**
Report of RV POSEIDON Cruise POS 272, Las Palmas - Las Palmas, 1.4.-14.4.2001.
19 pages, Bremen, 2002.

No. 198 **Gräfe, K.-U.**
Stratigraphische Korrelation und Steuerungsfaktoren Sedimentärer Zyklen in ausgewählten Borealen und Tethyalen Becken des Cenoman/Turon (Oberkreide) Europas und Nordwestafrikas.
197 pages, Bremen, 2002.

No. 199 **Jahn, B.**
Mid to Late Pleistocene Variations of Marine Productivity in and Terrigenous Input to the Southeast Atlantic.
97 pages, Bremen, 2002.

No. 200 **Al-Rousan, S.**
Ocean and climate history recorded in stable isotopes of coral and foraminifers from the northern Gulf of Aqaba.
116 pages, Bremen, 2002.

No. 201 **Azouzi, B.**
Regionalisierung hydraulischer und hydrogeochemischer Daten mit geostatistischen Methoden.
108 pages, Bremen, 2002.

No. 202 **Spieß, V. and cruise participants**
Report and preliminary results of METEOR Cruise M 47/3, Libreville (Gabun) - Walvis Bay (Namibia),
01.06 - 03.07.2000. 70 pages, Bremen 2002.

No. 203 **Spieß, V. and cruise participants**
Report and preliminary results of METEOR Cruise M 49/2, Montevideo (Uruguay) - Montevideo, 13.02 - 07.03.2001. 84 pages, Bremen 2002.

No. 204 **Mollenhauer, G.**
Organic carbon accumulation in the South Atlantic Ocean: Sedimentary processes and glacial/interglacial Budgets.
139 pages, Bremen 2002.

No. 205 **Spieß, V. and cruise participants**
Report and preliminary results of METEOR Cruise M49/1, Cape Town (South Africa) - Montevideo (Uruguay), 04.01.2000 - 10.02.2000.
57 pages, Bremen, 2003.

No. 206 **Meier, K.J.S.**
Calcareous dinoflagellates from the Mediterranean Sea: taxonomy, ecology and palaeoenvironmental application.
126 pages, Bremen, 2003.

No. 207 **Rakic, S.**
Untersuchungen zur Polymorphie und Kristallchemie von Silikaten der Zusammensetzung Me2Si2O5 (Me:Na, K).
139 pages, Bremen, 2003.

No. 208 **Pfeifer, K.**
Auswirkungen frühdiagenetischer Prozesse auf Calcit- und Barytgehalte in marinen Oberflächen-sedimenten. 110 pages, Bremen, 2003.

No. 209 **Heuer, V.**
Spurenelemente in Sedimenten des Südatlantik. Primärer Eintrag und frühdiagenetische Überprägung.
136 pages, Bremen, 2003.

No. 210 **Streng, M.**
Phylogenetic Aspects and Taxonomy of Calcareous Dinoflagellates.
157 pages, Bremen 2003.

No. 211 **Boeckel, B.**
Present and past coccolith assemblages in the South Atlantic: implications for species ecology, carbonate contribution and palaeoceanographic applicability.
157 pages, Bremen, 2003.

No. 212 **Precht, E.**
Advective interfacial exchange in permeable sediments driven by surface gravity waves and its ecological
consequences. 131 pages, Bremen, 2003.

No. 213 **Frenz, M.**
Grain-size composition of Quaternary South Atlantic sediments and its paleoceanographic significance.
123 pages, Bremen, 2003.

No. 214 **Meggers, H. and cruise participants**
Report and preliminary results of METEOR Cruise M 53/1, Limassol - Las Palmas – Mindelo, 30.03.2002 - 03.05.2002.
81 pages, Bremen, 2003.

No. 215 **Schulz, H.D. and cruise participants**
Report and preliminary results of METEOR Cruise M 58/1, Dakar – Las Palmas, 15.04..2003 - 12.05.2003. Bremen, 2003.

No. 216 **Schneider, R. and cruise participants**
Report and preliminary results of METEOR Cruise M 57/1, Cape Town – Walvis Bay, 20.01. – 08.02.2003.
123 pages, Bremen, 2003.

No. 217 **Kallmeyer, J.**
Sulfate reduction in the deep Biosphere.
157 pages, Bremen, 2003.

No. 218 **Røy, H.**
Dynamic Structure and Function of the Diffusive Boundary Layer at the Seafloor.
149 pages, Bremen, 2003.

No. 219 **Pätzold, J., C. Hübscher and cruise participants**
Report and preliminary results of METEOR Cruise M 52/2&3, Istanbul – Limassol – Limassol, 04.02. – 27.03.2002. Bremen, 2003.

No. 220 **Zabel, M. and cruise participants**
Report and preliminary results of METEOR Cruise M 57/2, Walvis Bay – Walvis Bay, 11.02. – 12.03.2003.
136 pages, Bremen 2003.

No. 221 **Salem, M.**
Geophysical investigations of submarine prolongations of alluvial fans on the western side of the Gulf of Aqaba-Red Sea.
100 pages, Bremen, 2003.

No. 222 **Tilch, E.**
Oszillation von Wattflächen und deren fossiles Erhaltungspotential (Spiekerooger Rückseitenwatt, südliche Nordsee).
137 pages, Bremen, 2003.

No. 223 **Frisch, U. and F. Kockel**
Der Bremen-Knoten im Strukturnetz Nordwest-Deutschlands. Stratigraphie, Paläogeographie, Strukturgeologie.
379 pages, Bremen, 2004.

No. 224 **Kolonic, S.**
Mechanisms and biogeochemical implications of Cenomanian/Turonian black shale formation in North Africa: An integrated geochemical, millennial-scale study from the Tarfaya-LaAyoune Basin in SW Morocco.
174 pages, Bremen, 2004. Report online available only.

No. 225 **Panteleit, B.**
Geochemische Prozesse in der Salz- Süßwasser Übergangszone. 106 pages, Bremen, 2004.

No. 226 **Seiter, K.**
Regionalisierung und Quantifizierung benthischer Mineralisationsprozesse.
135 pages, Bremen, 2004.

No. 227 **Bleil, U. and cruise participants**
Report and preliminary results of METEOR Cruise M 58/2, Las Palmas – Las Palmas (Canary Islands, Spain), 15.05. – 08.06.2003.
123 pages, Bremen, 2004.

No. 228 **Kopf, A. and cruise participants**
Report and preliminary results of SONNE Cruise SO175, Miami - Bremerhaven, 12.11 - 30.12.2003.
218 pages, Bremen, 2004.

No. 229 **Fabian, M.**
Near Surface Tilt and Pore Pressure Changes Induced by Pumping in Multi-Layered Poroelastic Half-Spaces.
121 pages, Bremen, 2004.

No. 230 **Segl, M. and cruise participants**
Report and preliminary results of POSEIDON Cruise POS 304, Galway – Lisbon, 05.10 - 22.10.2004.
27 pages, Bremen, 2004.

No. 231 **Meinecke, G. and cruise participants**
Report and preliminary results of POSEIDON Cruise POS 296, Las Palmas – Las Palmas, 04.04 - 14.04.2003.
42 pages, Bremen, 2005.

No. 232 **Meinecke, G. and cruise participants**
Report and preliminary results of POSEIDON Cruise POS 296, Las Palmas – Las Palmas, 12.04 - 26.04.2004.
49 pages, Bremen, 2005.

No. 234 **Feseker, T.**
Numerical Studies on Groundwater Flow in Coastal Aquifers.
219 pages. Bremen 2004.

No. 235 **Sahling, H. and cruise participants**
Report and preliminary results of R/V POSEIDON Cruise POS 317/4, Istanbul-Istanbul , 16 October - 4 November 2004.
92 pages, Bremen 2004.